GEORG-AUGUST-UNIVERSITÄT
GÖTTINGEN

Replication and transparency

Stata Self-Learning Course

Overview

Replication and transparency

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Replication and transparency

General remarks

- Minimum aim: computational reproducibility
- Better: Other people understand your data & code and can use it

- There are no universal guidelines for coding in Stata
- What follows is a compilation of different guidelines & own experience
- No “best solution”, no guarantee for completeness

General remarks

Some key principles

- Code and data should be consistent
    - ➢ Agree on standards such as naming conventions within your team
- Code and data should be as self-explanatory as possible & sufficiently commented/documented
    - ➢ Choose meaningful names for objects, comment workflow/decisions from the beginning
- Code should be as simple & short as possible
    - ➢ Only keep what is needed, structure your code

Overview

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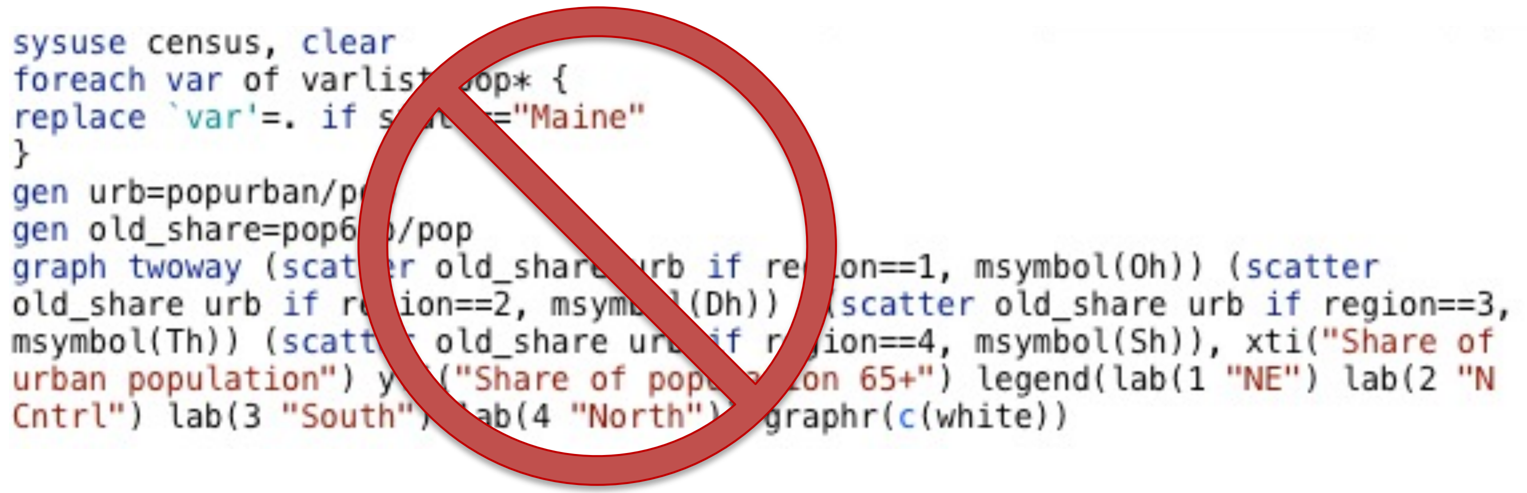
Readability of your code



```
sysuse census, clear
foreach var of varlist pop* {
replace `var'=. if state=="Maine"
}
gen urb=popurban/pop
gen old_share=pop65p/pop
graph twoway (scatter old_share urb if region==1, msymbol(Oh)) (scatter
old_share urb if region==2, msymbol(Dh)) (scatter old_share urb if region==3,
msymbol(Th)) (scatter old_share urb if region==4, msymbol(Sh)), xti("Share of
urban population") yti("Share of population 65+") legend(lab(1 "NE") lab(2 "N
Cntrl") lab(3 "South") lab(4 "North")) graphr(c(white))
```

- Structure your code to enhance readability
  - Use line breaks & indentation
  - Use * /* // for headings & comments
  - Break code into multiple lines with /// or #delimit
  - ➢ Agree with team on a style

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Title: Project & title of do-file

Introduction: What does this file do?

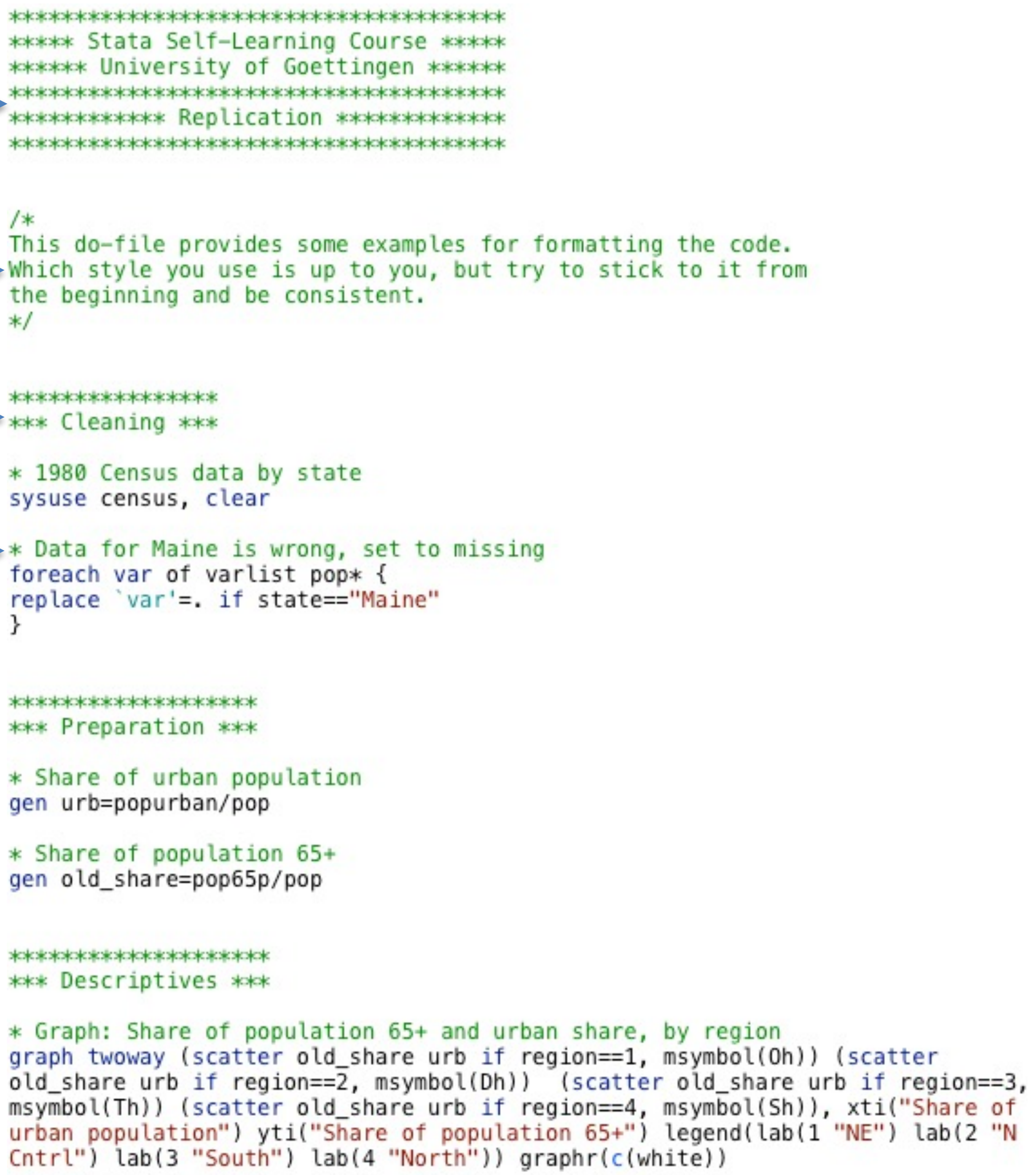
Meaningful headings to structure the file

Comment on decisions

The granularity of comments should balance between explanation of the code and readability: Which information is needed? Which congests the code?

Marking open/important decisions might be useful (e.g. //!\\)

This is only an example. The exact style is not important, as long as it is clear.



```
**************************************
***** Stata Self-Learning Course *****
****** University of Goettingen ******
**************************************
************ Replication *************
**************************************


/*
This do-file provides some examples for formatting the code.
Which style you use is up to you, but try to stick to it from
the beginning and be consistent.
*/


****************
*** Cleaning ***

* 1980 Census data by state
sysuse census, clear

* Data for Maine is wrong, set to missing
foreach var of varlist pop* {
replace `var'=. if state=="Maine"
}


*******************
*** Preparation ***

* Share of urban population
gen urb=popurban/pop

* Share of population 65+
gen old_share=pop65p/pop


********************
*** Descriptives ***

* Graph: Share of population 65+ and urban share, by region
graph twoway (scatter old_share urb if region==1, msymbol(Oh)) (scatter
old_share urb if region==2, msymbol(Dh))  (scatter old_share urb if region==3,
msymbol(Th)) (scatter old_share urb if region==4, msymbol(Sh)), xti("Share of
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```

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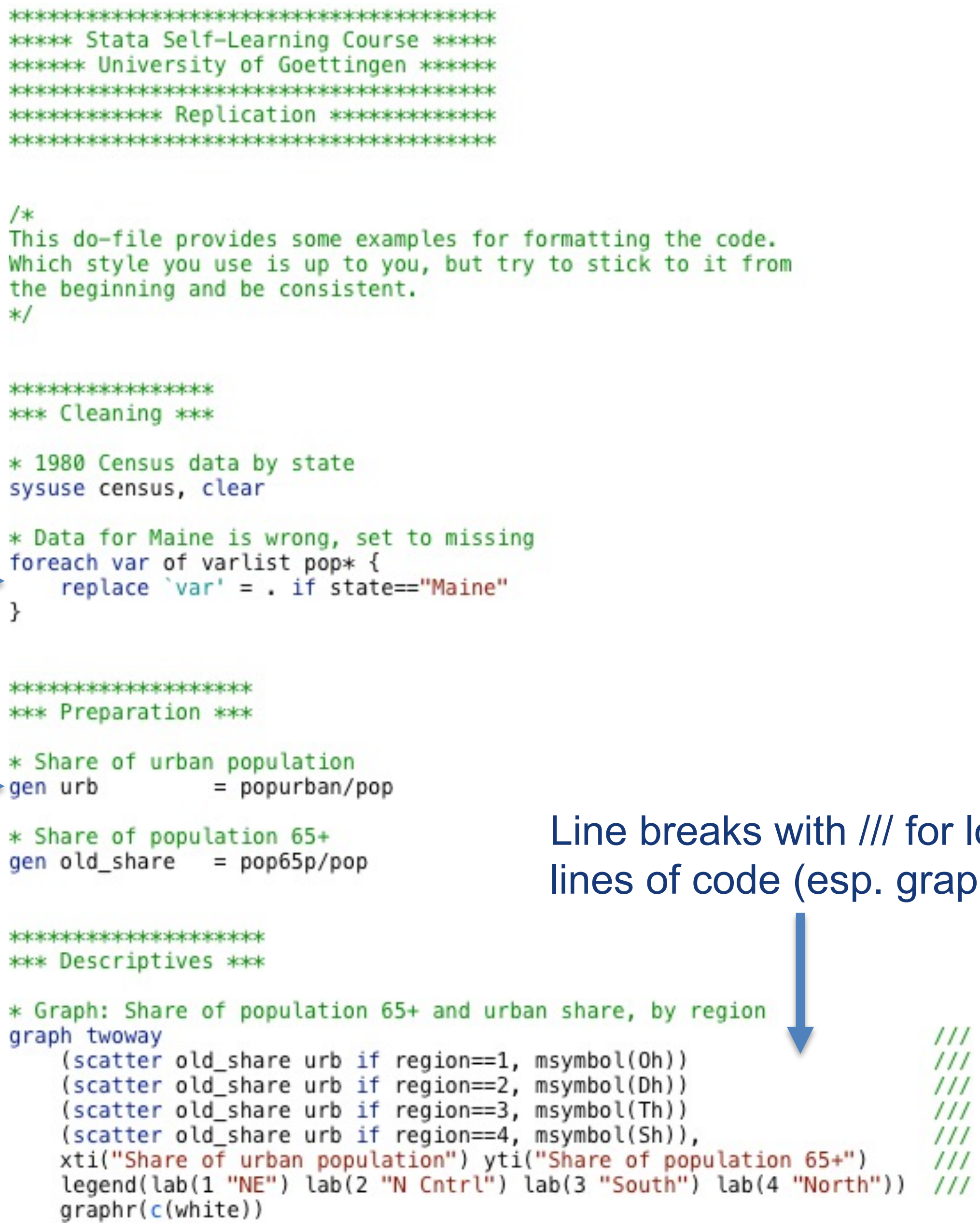

```
**************************************
***** Stata Self-Learning Course *****
****** University of Goettingen ******
**************************************
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foreach var of varlist pop* {
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*** Preparation ***

* Share of urban population
gen urb         = popurban/pop

* Share of population 65+
gen old_share   = pop65p/pop


********************
*** Descriptives ***

* Graph: Share of population 65+ and urban share, by region
graph twoway                                                    ///
    (scatter old_share urb if region==1, msymbol(Oh))          ///
    (scatter old_share urb if region==2, msymbol(Dh))          ///
    (scatter old_share urb if region==3, msymbol(Th))          ///
    (scatter old_share urb if region==4, msymbol(Sh)),         ///
    xti("Share of urban population") yti("Share of population 65+")    ///
    legend(lab(1 "NE") lab(2 "N Cntrl") lab(3 "South") lab(4 "North"))  ///
    graphr(c(white))
```

Indentation for loops, if-branches etc.

Might use tabs within a line (but too many can make it worse)

Line breaks with /// for long lines of code (esp. graphs)

This is only an example. The exact style is not important, as long as it is clear.

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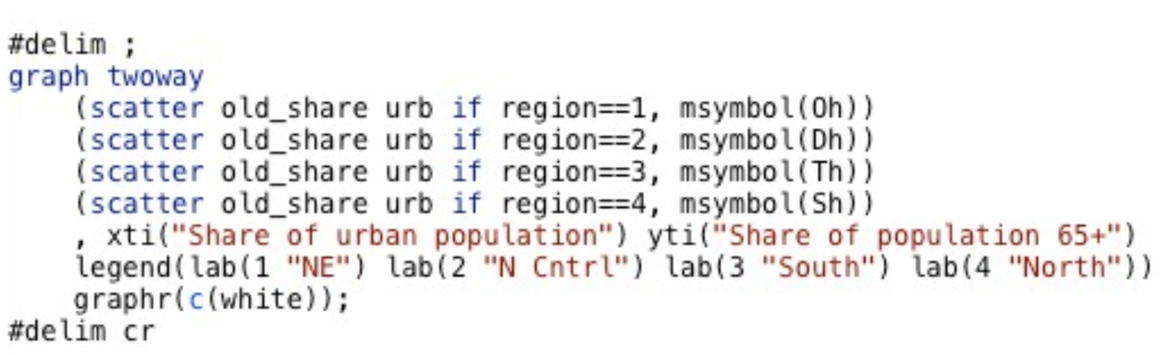
You can also use `#delim` to change the meaning of line breaks. Normally, line breaks mean the end of a command. With `#delim ;` the semicolon means the end of the command, and you can use line breaks for formatting. `#delim cr` changes this back to normal mode



```
#delim ;
graph twoway
    (scatter old_share urb if region==1, msymbol(Oh))
    (scatter old_share urb if region==2, msymbol(Dh))
    (scatter old_share urb if region==3, msymbol(Th))
    (scatter old_share urb if region==4, msymbol(Sh))
    , xti("Share of urban population") yti("Share of population 65+")
    legend(lab(1 "NE") lab(2 "N Cntrl") lab(3 "South") lab(4 "North"))
    graphr(c(white));
#delim cr
```

This is only an example. The exact style is not important, as long as it is clear.

Readability of your code (and data)

- Names should be descriptive/self-explanatory
  - Variables
  - Macros
  - Files

➢ Agree with team which naming conventions make sense

Example:

- Your data is based on a long questionnaire. Should variables be named after question number (q_35_2) or “title” (income_job_2)?
- The first is easier to combine with the supplementary material (and unambiguous)
- The latter is easier to memorize & recognize when coding

Readability of your data

Structure & content of the dataset should be clear:

- Use meaningful variable labels & notes (see next slide)
- Use meaningful value labels (and check their consistency)
- Use meaningful missing values where appropriate (e.g., .d for "don't know", .r for "refused" etc.)

- Order important variables such as identifiers, country names, dates/year at the top
- Check meaningful unique identifier(s)
- Provide further documentation material outside of Stata

Readability of your data

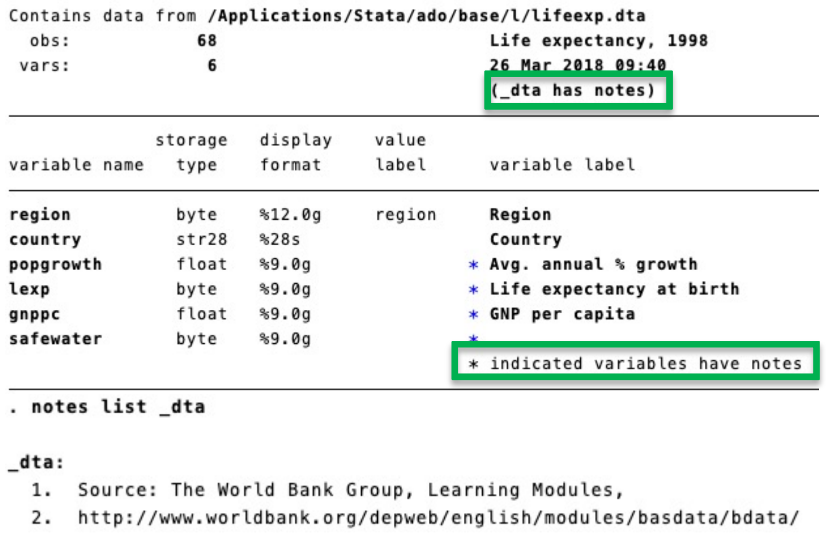
Variable labels

- Very easy to find → quick overview on variable content
- But: Might not want all information in label, as labels are used for outputs such as tables or graphs

Notes/characteristics

- Can be very detailed
- But: not everyone knows them
- Characteristics are a more advanced version of note

`help note`; `help char`



```
Contains data from /Applications/Stata/ado/base/l/lifeexp.dta
  obs:            68                          Life expectancy, 1998
 vars:             6                          26 Mar 2018 09:40
                                              (_dta has notes)
------------------------------------------------------------------------------
              storage   display    value
variable name   type    format     label      variable label
------------------------------------------------------------------------------
region          byte    %12.0g     region     Region
country         str28   %28s                  Country
popgrowth       float   %9.0g               * Avg. annual % growth
lexp            byte    %9.0g               * Life expectancy at birth
gnppc           float   %9.0g               * GNP per capita
safewater       byte    %9.0g               *
                                            * indicated variables have notes
------------------------------------------------------------------------------
. notes list _dta

_dta:
  1.  Source: The World Bank Group, Learning Modules,
  2.  http://www.worldbank.org/depweb/english/modules/basdata/bdata/
```

Readability: Some remarks

- What’s considered “readable” varies immensely
- Also, there might be trade-offs between what’s considered readable & what’s practical

  For example, some propose to never abbreviate commands. That’s something I personally wouldn’t consider as a huge increase in readability as the abbreviations are so common, and I would have to exert some effort to break my habit of using them. Others find it annoying to put white spaces between “=“, while I find they increase readability. Then again, some propose to keep do-files short and rather use many do-files, while others prefer having less files.

- Always try to make your code readable for others. But: There’s no sense in setting standards if they are not followed through

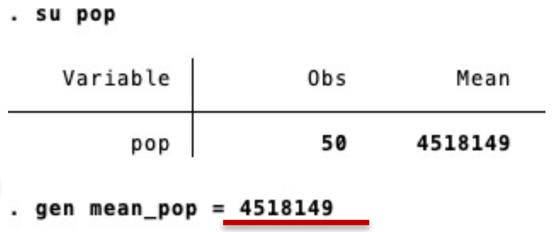
Overview

Replication and transparency

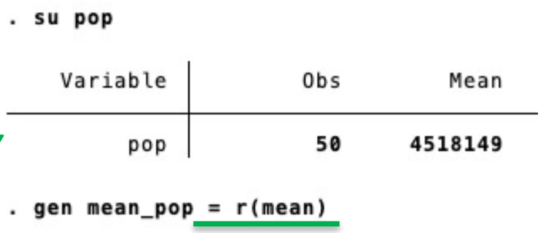
Abstraction & automation

Do everything as abstract as possible

- Try to **never ever** “hard code” values in your code
- Instead, use
  - return objects & ereturn objects & system variables

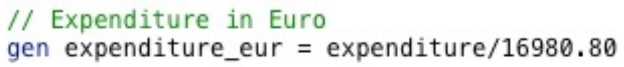


```
. su pop

    Variable |        Obs        Mean
-------------+------------------------
         pop |         50     4518149

. gen mean_pop = 4518149
```

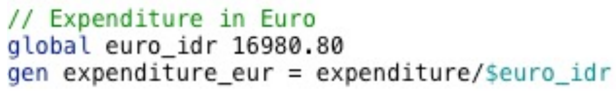


```
. su pop

    Variable |        Obs        Mean
-------------+------------------------
         pop |         50     4518149

. gen mean_pop = r(mean)
```

  - macros & macro functions



```
// Expenditure in Euro
gen expenditure_eur = expenditure/16980.80
```



```
// Expenditure in Euro
global euro_idr 16980.80
gen expenditure_eur = expenditure/$euro_idr
```

- Use automated (export) tables & graphs whenever possible
  - See chapter on advanced graphs & tables and on putdocx

Abstraction & automation

Minimize copy & paste: Definitions etc. should be done **at one point only** to prevent inconsistencies & errors

- Most obvious example: Use loops for repetitive tasks

```
foreach var of varlist pop* {
    replace `var' = . if state=="Maine"
    note `var': "Data for Maine is wrong and was set to missing"
}
```

- Use the same do-file for definitions which re-occur at different steps, e.g., creating an index at base- & endline

```
use "raw/baseline.dta", clear
    /*
    do some cleaning
    */
    run "wealth_quintiles.do"
save "prep/baseline_cleaned.dta", replace
```

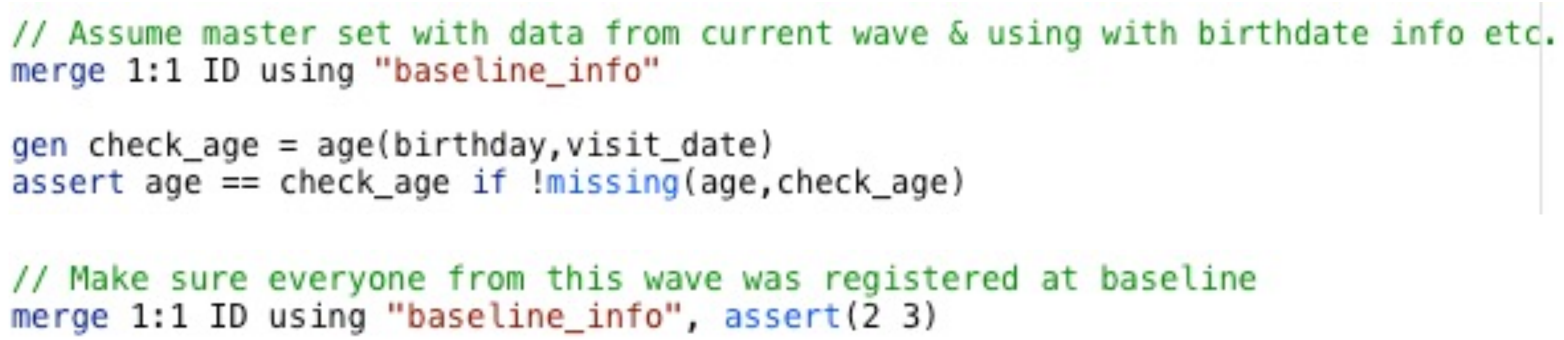
```
use "raw/endline.dta", clear
    /*
    do some other cleaning
    */
    run "wealth_quintiles.do"
save "prep/endline_cleaned.dta", replace
```

- For more complex repetitive tasks: Write programs (.ado-files)

Abstraction & automation

Use (automated) error checks to make sure everything works as intended, using for example:

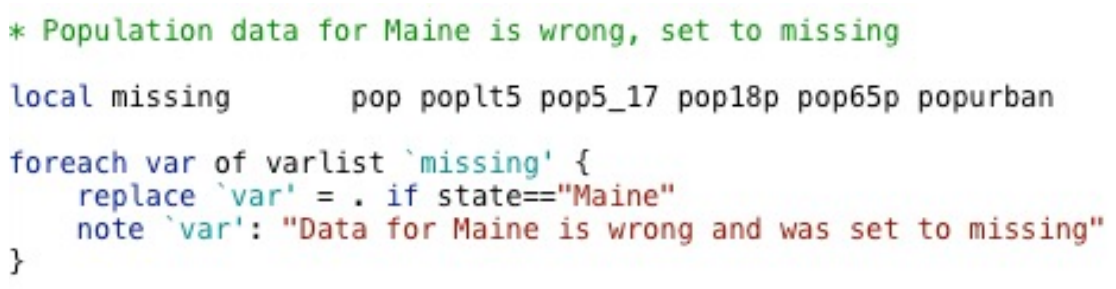
- `isid`
- `confirm`
- `assert`
- merge options



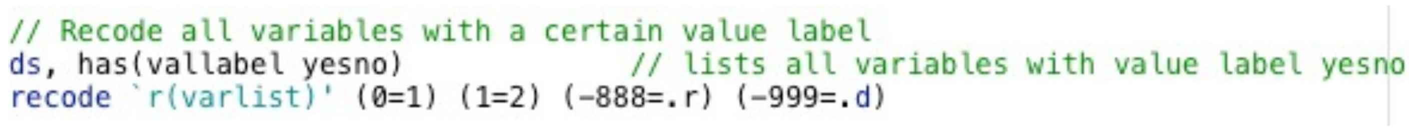
```
// Assume master set with data from current wave & using with birthdate info etc.
merge 1:1 ID using "baseline_info"

gen check_age = age(birthday,visit_date)
assert age == check_age if !missing(age,check_age)

// Make sure everyone from this wave was registered at baseline
merge 1:1 ID using "baseline_info", assert(2 3)
```

Abstraction & automation

- What to do about variable lists?
  - Can be useful if variables are consistently ordered/named
  - BUT: can also easily lead to errors if order/names change
  - Consider using macros or the `ds` command



```
* Population data for Maine is wrong, set to missing

local missing       pop poplt5 pop5_17 pop18p pop65p popurban

foreach var of varlist `missing' {
    replace `var' = . if state=="Maine"
    note `var': "Data for Maine is wrong and was set to missing"
}
```



```
// Recode all variables with a certain value label
ds, has(vallabel yesno)                 // lists all variables with value label yesno
recode `r(varlist)' (0=1) (1=2) (-888=.r) (-999=.d)
```

- Some commands allow incomplete varnames as input, e.g., “med” instead of “medage” (not to be confused with “med*”)
- This can easily lead to mistakes → use `set varabbrev off`

Overview

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Folder structure

Have a clear folder structure & file system

- Separate “raw” from prepared data, inputs from outputs, etc.
- Provide a ReadMe-file in the main folder:
  - Contains all information to understand structure & run files
- Master Do-File:
  - Contains settings, globals, etc.
  - Runs all do-files in the correct order
- Recommended: Also provide data & code to build analysis dataset from “raw” (de-identified) dataset

Folder structure

Decide on a system for version control of files & documentation

- Github (e.g. https://github.com/BITSS/wb_reusable_analytics)
- OSF (https://osf.io/)
- Limited version control with owncloud
- Can use `creturn list` to capture date/user/system (see next slide)
- Can use `datasignature` to check whether data changed & `cf` to see how datasets differ

Folder structure

Directories & paths

- **Never** use the Windows „\“ in file paths! They don‘t work on Mac & Linux and cause problems when using globals!
- Two possible ways to define (flexible) filepaths:

A. Set directory (in Master do-file) & use relative filepaths

```
cd  "/Users/anna/ownCloud/Project"
use "data/raw/baseline.dta", clear
```

B. Put directory in a global (in Master do-file) & use global for absolute filepaths

```
global dir  "/Users/anna/ownCloud/Project"
use         "$dir/data/raw/baseline.dta", clear
```

- Possible ways to get the correct filepath automatically
  - profile.do (https://julianreif.com/guide/#stata-profile)
  - creturn list: c(username) (see DIME Master Do-file)
  - creturn list: c(pwd) (IPA cleaning guide)

Overview

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Version control of Stata & Stata commands

- Stata version control:
  - command "`version`" to set Stata version (set to the lowest version possible to ensure widest application)
  - might use ieboilstart by DIME to also harmonize settings
- Version control of user-written commands
  - There is no automatic version control for user-written commands!
  - Save all used user-written commands in a separate folder such that others can use them in exact the same version you did
  - Run them all in the Master do-file
- Examples: Master do-file by DIME / script by Julian Reif

Overview

Replication and transparency

References & further reading

This was just a selection. You can find more examples & detailed guidelines here:

- Asjad Naqvi. The Stata Guide: Stata and GitHub Integration. Online version of PDF available at https://medium.com/the-stata-guide
- Asjad Naqvi. The Stata Guide: The Stata workflow guide. Online version of PDF available at https://medium.com/the-stata-guide
- DIME Example (including Master do-file): https://github.com/worldbank/rio-safe-space
- DIME Handbook: https://worldbank.github.io/dime-data-handbook/
- Gentzkow, Matthew and Jesse M. Shapiro. 2014. Code and Data for the Social Sciences: A Practitioner's Guide. University of Chicago mimeo, http://faculty.chicagobooth.edu/matthew.gentzkow/research/CodeAndData.pdf, last updated January 2014.
- IPA Data cleaning guide: https://povertyaction.github.io/guides/cleaning/readme/
- IPA Reproducible Research: Best Practices for Data and Code Management: https://www.poverty-action.org/publication/ipas-best-practices-data-and-code-management
- J-PAL Guide to Publishing Research Data (online version of PDF available at https://www.povertyactionlab.org/resource/data-publication)
- Julian Reif: Coding practices: https://julianreif.com/guide/