Creating Self-Validating Datasets

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1. Goals
   - Goals for Validation
   - Implementation Goals
2. Implementation
   - The Interface
   - Validation Rules
   - Other Tools
3. Demo of Package
   - The Data
   - Adding Rules
   - Checking the Data
   - Reusing Your Work
   - Other Notes

Outline II

4 Finishing Up
- Extensions
- Unfinished Business
- Questions?

5 Post-Conclusion
- What Holds the Rules?
- How Are the Rules Used?

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Validation Should Be in Dataset

- Currently, validation is contained in
  - Outside documentation
  - Outside programs (do/ado files)
- Can be separated from data too easily
  - Not shared well, either

Validation Should Be Persistant

- Validation must follow variables through manipulation.
  - Merges
  - Subsetting variables
  - Subsetting observations
  - Appending
- Validation rules must be attached to variables themselves.

Validation Should Be Easy

- Can attach most validation knowing no Stata
- Can attach most of what is left knowing minimal Stata
- Do not need to know a lot of programming tricks
- Not Easy == Not Used

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Making Friendly, Part 1

- Use simple syntax for simple checks.
    - When possible use syntax(es) familiar to both experienced and new Stata users.
- Most checks use ranges or lists, so these are of top priority.
- Try to avoid using any kind of Stata programming.
- Make this somewhat odd method invisible to the casual user and clear to the aficiando.

Making Friendly, Part 2

- Use a simple interface for simple needs.
  - Be sure that users cannot get lost.
  - Protect against inadvertent undesirable changes.
- Try to use a simple interface for complex needs.
- Perhaps a dialog box as the main interface?

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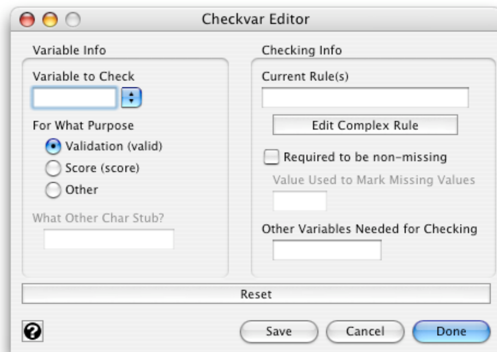
Tools

- A dialog box, `ckvaredit`, which takes care of attaching the characteristics,
- A command, `ckvar`, which runs through the variables and does the validation,
- A helper command, `ckvardo`, which turns the characteristics into a do-file which could be used with other, similar datasets.

The Dialog Box

- Here it is:



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Valid Validation Rules

- Simple rules—no Stata knowledge needed
  - Bounds
  - Ranges
  - Sets
- Complicated rules—for complicated validation
  - Full-fledged do-files or complicated commands

Validation Using Bounds

- For one-sided bounds on the values of a variable
- Syntax: { >= | > | == | < | <= } #
- Examples:
  - \>=0
  - <5

Validiation Using `in` and Sets

- For more complicated sets, such as ranges or individual values
- Syntax `in` *set* [`&` | | | `!` *set* . . .]
- Sets can be specified in a number of ways.
- Logic works, using Stata's operators
  - Parentheses do **not** work, unfortunately

Specifying Sets

- For discrete sets of numbers or strings:
  - Set notation works.
  - Stata's *numlist*s work for numbers.
- For continuous ranges of numbers:
  - Set notation works: round brackets: (and) **do not** include endpoints, square brackets: [ ] **do** include endpoints
  - Use **.** to denote infinity, and **–.** to denote minus infinity

`in` Examples

- `in {1,2,3,4,5}`
- `in 1/5` is the same as above
- `in [0,5]` is any number between 0 and 5, inclusive
- `in [0,1)` is any number from 0 to under 1
- `in [0,.)` is the same as `>=0`

How to Enter Validation Rules (Complex)

- These are simply Stata commands with some slight twists which keep everything functioning.
  - Use `` `self' `` to refer to the variable being checked
  - Use `` `valid' `` for valid values, and `` `error' `` for invalid values
- These are entered using the do-file editor, as we'll see.

How to Avoid Reentering Rules

- Can use `like` *varname* to check just like another variable.
- One big reason for using `` `self' ``!

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Keeping Track of Dependencies

- Using `like` or programs makes new dependencies among variables.
- Should not be able drop or rename needed variables.
- Be sure to put the variables in the **Other Variables Needed** . . . box.
- Use `ckdrop`, `ckkeep`, and `ckrename`.

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The `example.dta` Dataset

- `use example` brings in an example dataset.
- `describe` is enough to set up the validation rules!
  - Ha! How often does that happen?

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Entering the Rules

- Type `ckvaredit` at the Stata prompt, and start
  - `id` already has a rule, so we'll skip and come back later.
- It would be nice to have a way to step through all the variables.
  - Surprise! The `stepthru` option will go from one variable to the next.
- When finished, the dataset has been marked as dirty, so that it is harder to throw away the validation work.
- Save this—`"save example cked"`

Document the Validation Rules

- Try `ckcodebook`
- Shows all the error checks

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Simple Use of `ckvar`

- Try `ckvar`
- Done!

Data with Identifiers

- `ckvar` can be used to be sure that identifiers are distinct.
- Drop the all the error variables
  - `drop error*`
- `ckvar, key(id)`
  - Aha! There are duplicates
- Drop the `error*` variables, again
- `ckvar, key(id) markdups(duplicate)`

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Make a Do-file for Future Datasets

- Try `ckvardo using example.do, replace`
- To see the do-file: `doedit using example.do`
  - Notice the backslashes in front of the open-quotes!
  - Can see how it works: Characteristics
- To see it in action:
  - `ckvarclear` to clear out all the characteristics.
  - `do example`
  - `drop error*`
  - `ckvar`

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Keeping, Dropping and Renaming

- We need some protection to keep variables needed for validation from disappearing or being renamed.
- `ckkeep`, `ckdrop`, and `ckrename` try to take care of this.
- Examples
  - `ckdrop rating1` does nothing, because `rating1` is needed for checking the other `rating` variables, as well as `best`.
  - `ckrename rating3` fails because `best` needs `rating3` for validation.
  - `ckkeep id best` keeps some extra variables.

Clean Slate?

- The `ckvarclear` command will clean out all the characteristics.
- Should really be used only for debugging!

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Scoring *vs.* Validating

- This package can also be used for scoring instruments.
- Instead of generating error markers, will generate a score for each variable and each observation, as well as a maximum possible score.
- The distinction between scoring and validating is small: two values (for validation) or many values (for scoring).

Automation Through Templates

- Can use `ckvardo` to generate do-files.
- Can make dataset templates for standard datasets, instead.
  - Make an empty dataset with the proper variable names, and then add the rules.
  - Use a dictionary (or some other mechanism) to make sure data have proper variable names.
  - Append data set to template to implement validation or scoring.

Other Notes about `ckvar`

- Can keep working through the face of problems by using the `keepgoing` option.
  - Good for big datasets
- For debugging, the `loud` option is good for echoing lots of esoteric output.

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Not Yet Implemented Tools

- Could attach keys directly via a `char _dta[key]`, perhaps.
  - There is some danger, because this should not survive a `merge`.
- Need ways to run corruption checks more easily.

Commands Which Need Modification

- `reshape` could be OK in many cases.
  - Going wide to long: keep the rules for the first variable
  - Going long to wide: put the rule in the first variable, make the rest use `like`
- Need checks when appending, so that conflicting rules do not overwrite each other.

Possible Trickiness

- Need way to keep validation or scoring if there are many types of rules attached to each variable, all with their own dependencies.
- It would be nice to automatically detect other variables needed, instead of relying on the user to notify the dataset.

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Questions?

- Ask away!

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Characteristics Store the Rules

- Characteristics . . .
  - . . . allow attaching large amounts of text to any variable or the dataset.
  - . . . follow variables through data manipulations.
  - . . . can have arbitrary names.
- These are one of the most undervalued pieces of Stata.

Understanding Characteristics' Names

- The characteristics' names have 2 pieces.
  - A **prefix** which often conveys its grand purpose, but which can be overridden.
  - A **suffix** which conveys its specific purpose within the grand purpose.
  - The two are separated by an underscore (_).
- Examples:
  - `valid_rule` holds a validation rule.
  - `score_required` says there should be no missing values when scoring.

Prefixes

- Defaults
  - `valid` is the default for validation.
  - `score` is the default for scoring.
- Any prefix can be used in place of these.
  - Useful for scoring, if there are multiple scores which can result.
  - Otherwise should be avoided, because others will expect the defaults.

Suffixes

- `rule` contains the rule to be evaluated.
- `required` for whether valid values are required. If not specified, this is treated as “no”.
- `other_vars_needed` lists those variables needed for the validation or scoring.
- `missval` contains the value used to tag missing values when missing values are invalid.
- These may **not** be changed.

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Executing Characteristics

- `ckvar` calls a program called `dochar`, which is a utility for running code stored in characteristics.
  - This could be used by others for their own embedded code.
- `dochar` looks for `in` or `like`, and failing that, saves the commands to a temporary do-file, which is then executed.
- `dochar` has arguments for passing through temporary macro names.
  - This is the one place where things get a bit sticky.
- More detail available through `help dochar`.