THE WORLD BANK
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Development Economics • Impact

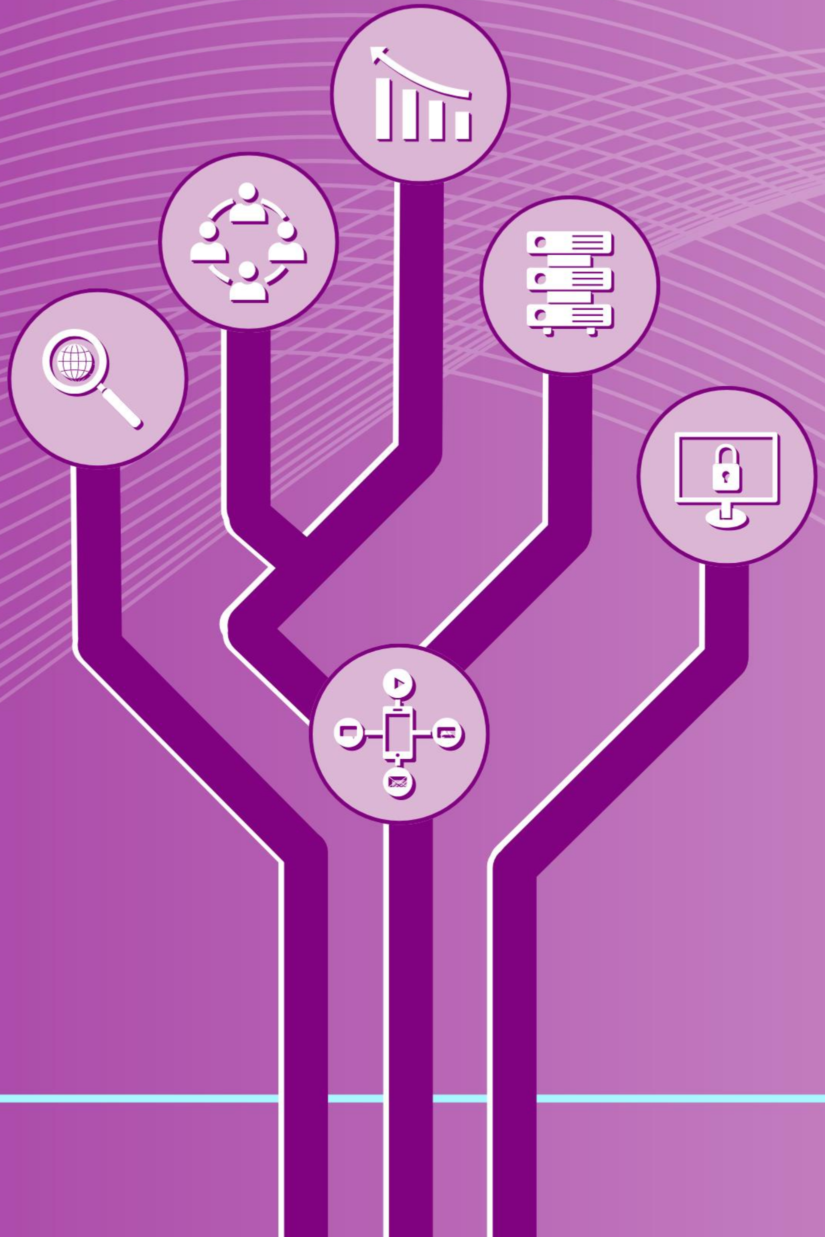
DIME
ANALYTICS

reprun

Automating complete reproducibility verifications

Benjamin Daniels and Ankriti Singh

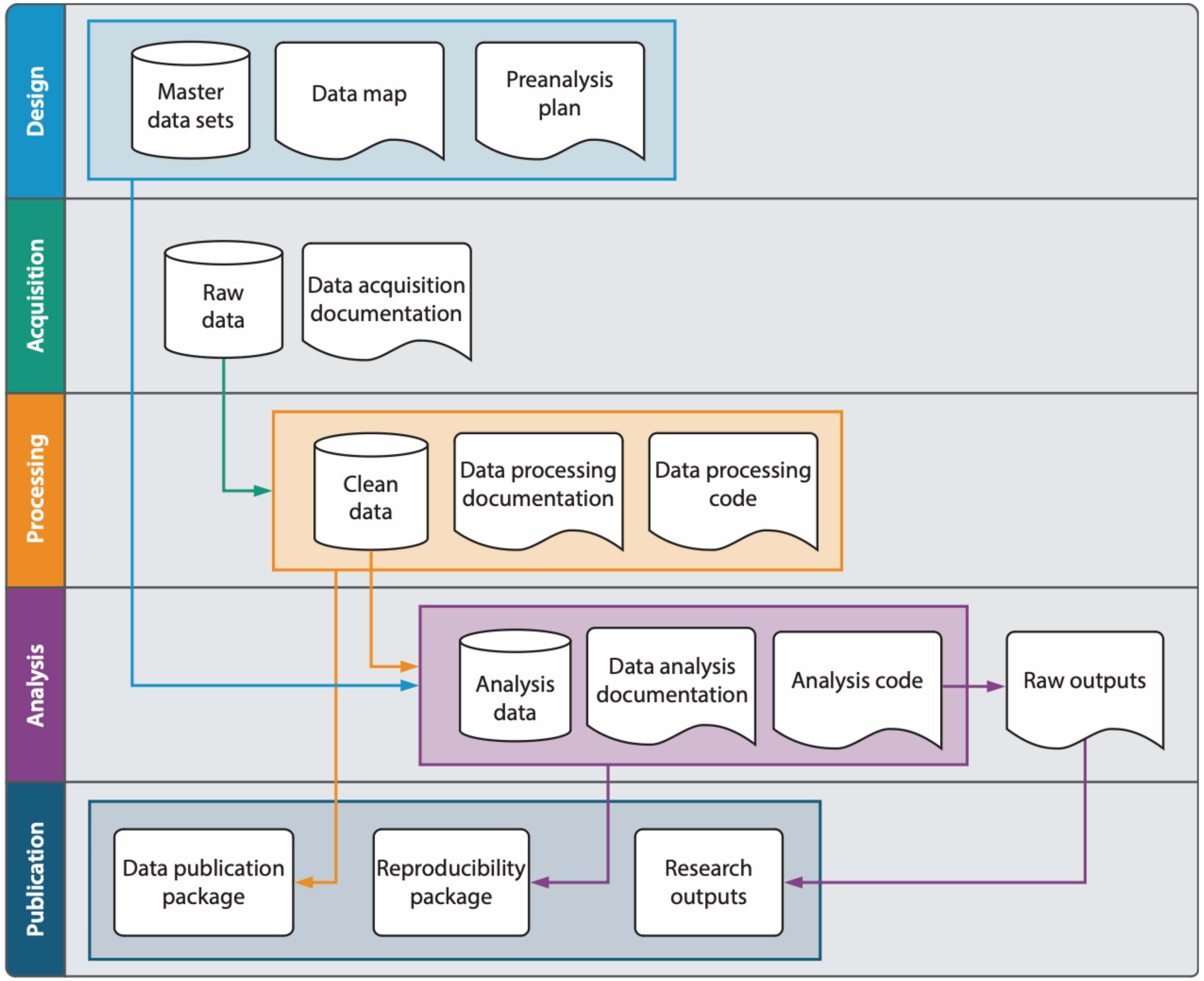
Stata Conference 2024



Motivation

Research Workflow at DIME

FIGURE 8.1 **Research data work outputs**



Design

Master data sets

Data map

Preanalysis plan

Acquisition

Raw data

Data acquisition documentation

Processing

Clean data

Data processing documentation

Data processing code

Analysis

Analysis data

Data analysis documentation

Analysis code

Raw outputs

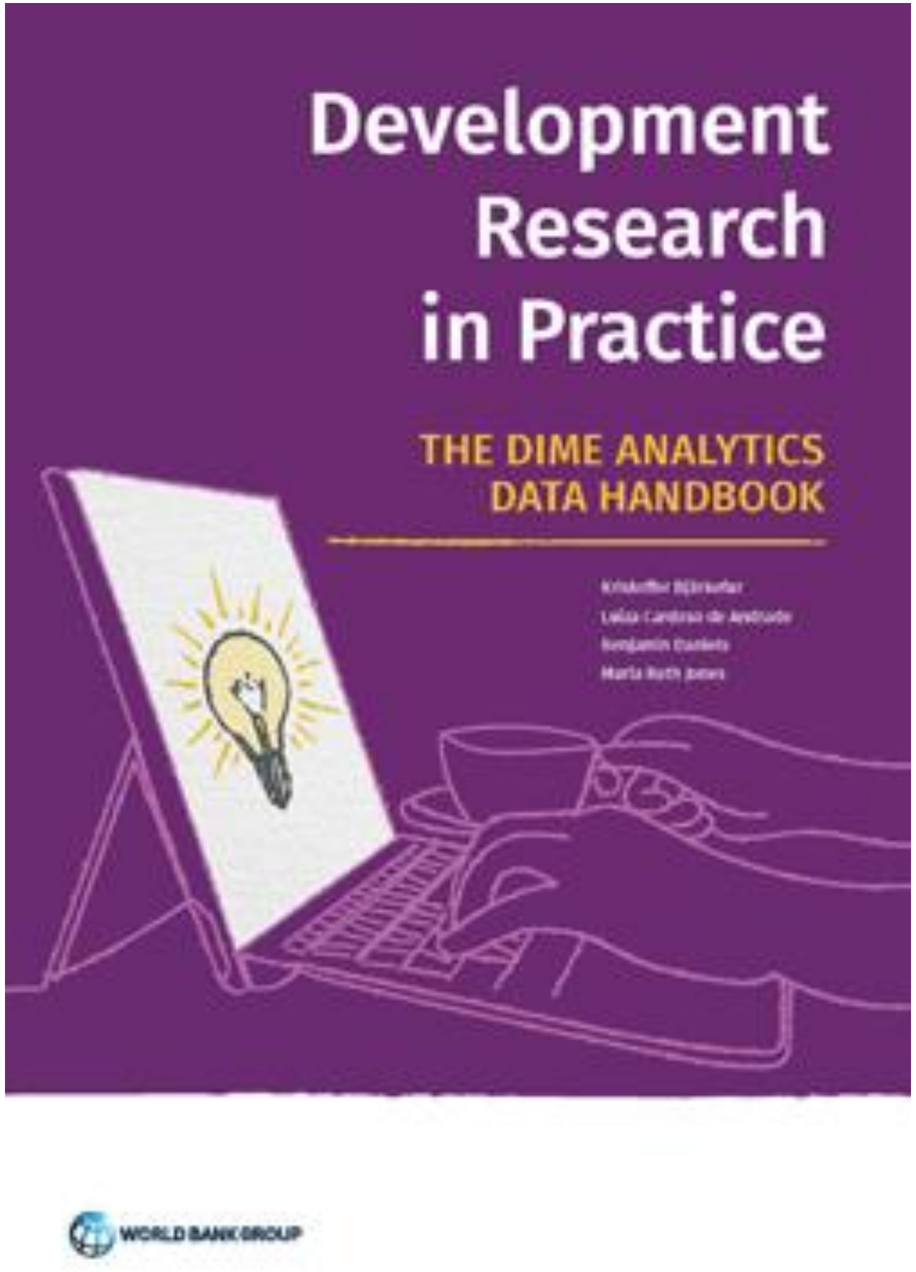
Publication

Data publication package

Reproducibility package

Research outputs

Source: DIME (Development Impact Evaluation), World Bank.



Development Research in Practice

THE DIME ANALYTICS DATA HANDBOOK

Kristoffer Bjärkefur

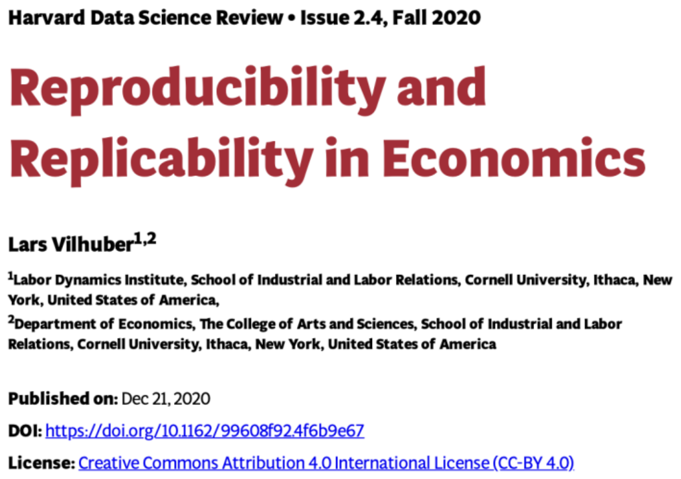
Luíza Cardoso de Andrade

Benjamin Daniels

Maria Ruth Jones

WORLD BANK GROUP

Stata Remains Dominant in Economics/Development



Harvard Data Science Review • Issue 2.4, Fall 2020

Reproducibility and Replicability in Economics

Lars Vilhuber[1,2]

[1]Labor Dynamics Institute, School of Industrial and Labor Relations, Cornell University, Ithaca, New York, United States of America,

[2]Department of Economics, The College of Arts and Sciences, School of Industrial and Labor Relations, Cornell University, Ithaca, New York, United States of America

Published on: Dec 21, 2020

DOI: https://doi.org/10.1162/99608f92.4f6b9e67

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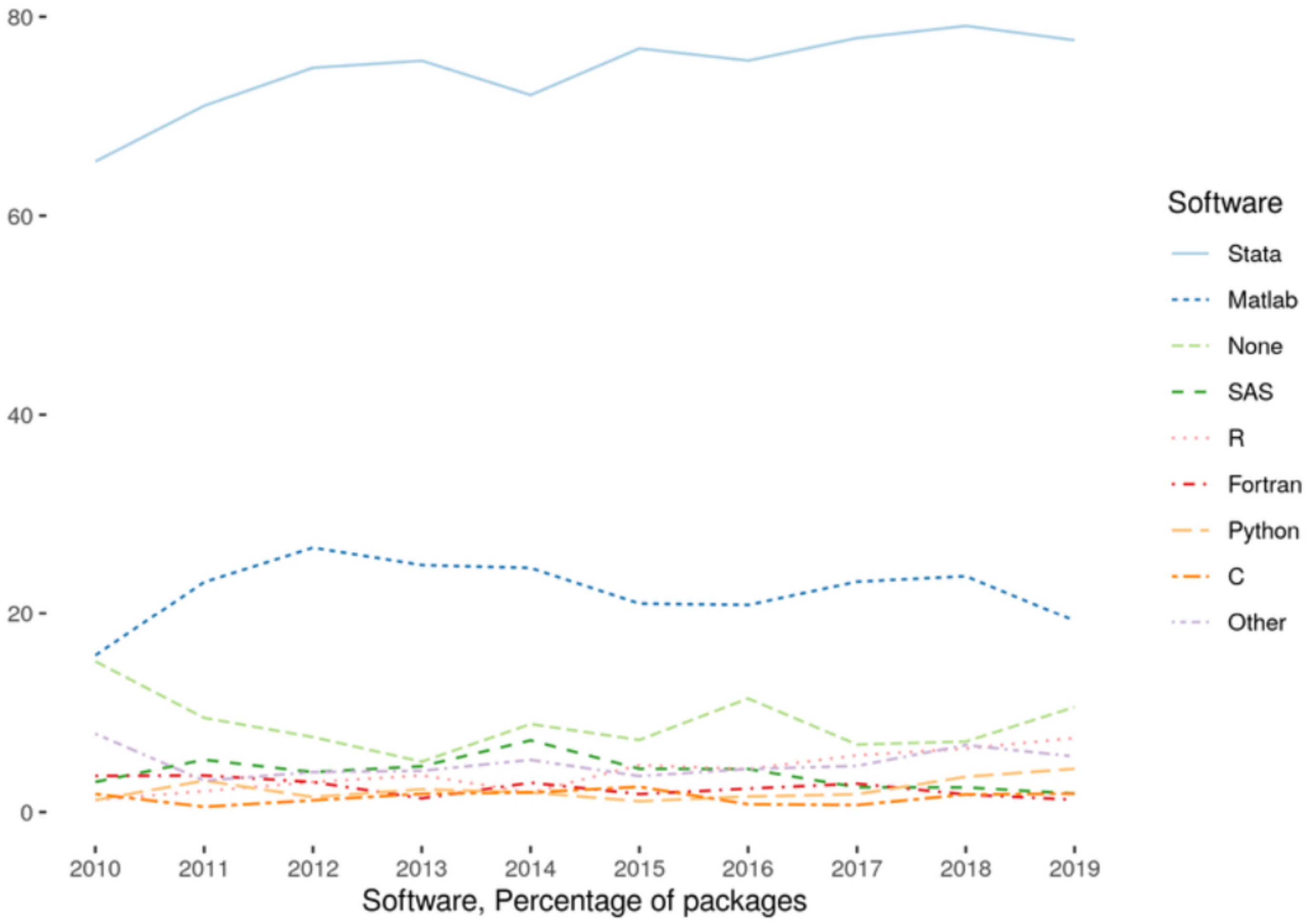
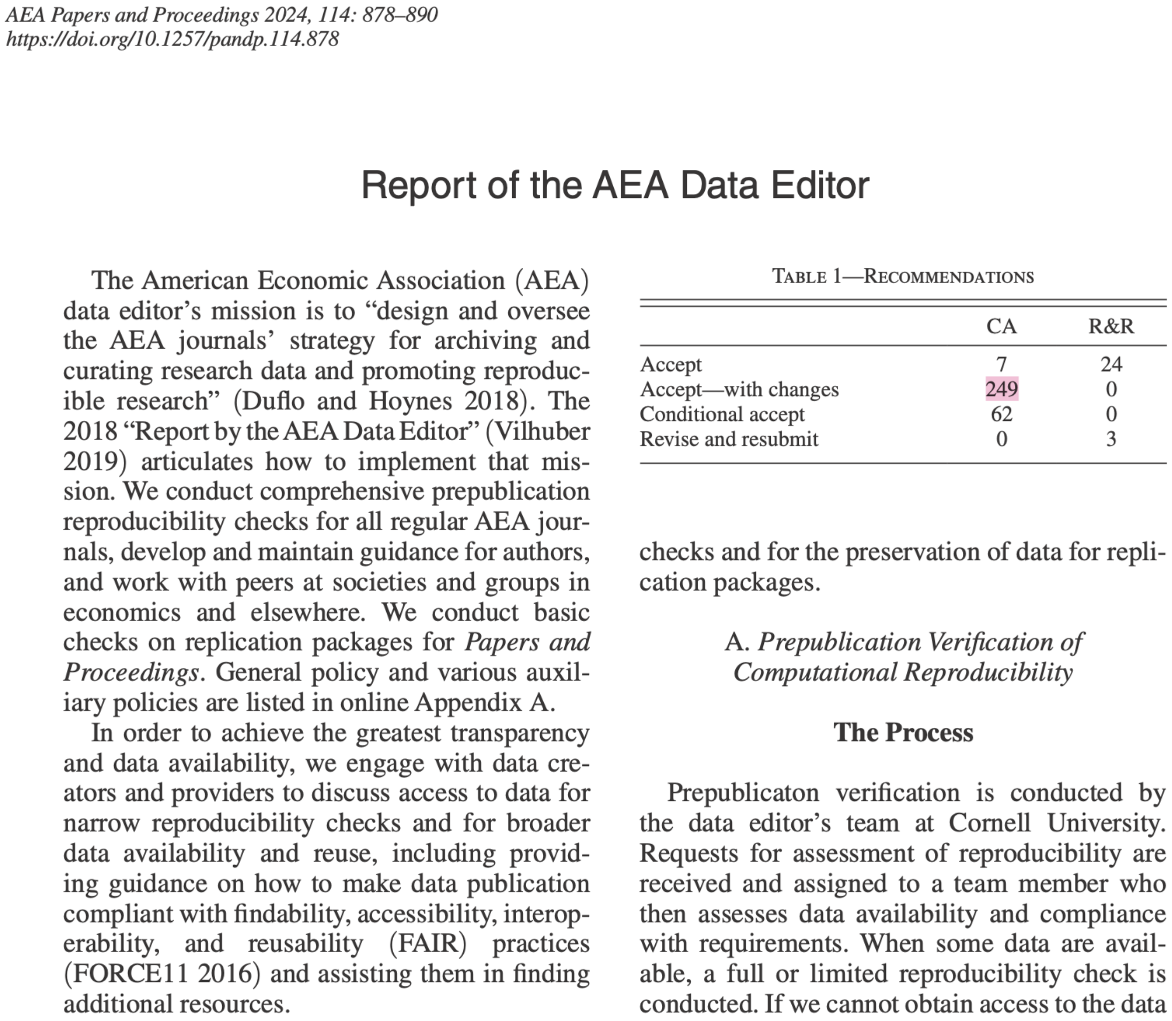


Figure 2. Software usage in supplements to journals of the American Economic Association, based on parsing of file extensions. From Vilhuber (2020)

Reproducibility Remains a Challenge



AEA Papers and Proceedings 2024, 114: 878–890
https://doi.org/10.1257/pandp.114.878

Report of the AEA Data Editor

The American Economic Association (AEA) data editor's mission is to "design and oversee the AEA journals' strategy for archiving and curating research data and promoting reproducible research" (Duflo and Hoynes 2018). The 2018 "Report by the AEA Data Editor" (Vilhuber 2019) articulates how to implement that mission. We conduct comprehensive prepublication reproducibility checks for all regular AEA journals, develop and maintain guidance for authors, and work with peers at societies and groups in economics and elsewhere. We conduct basic checks on replication packages for *Papers and Proceedings*. General policy and various auxiliary policies are listed in online Appendix A.

In order to achieve the greatest transparency and data availability, we engage with data creators and providers to discuss access to data for narrow reproducibility checks and for broader data availability and reuse, including providing guidance on how to make data publication compliant with findability, accessibility, interoperability, and reusability (FAIR) practices (FORCE11 2016) and assisting them in finding additional resources.

Table 1—Recommendations

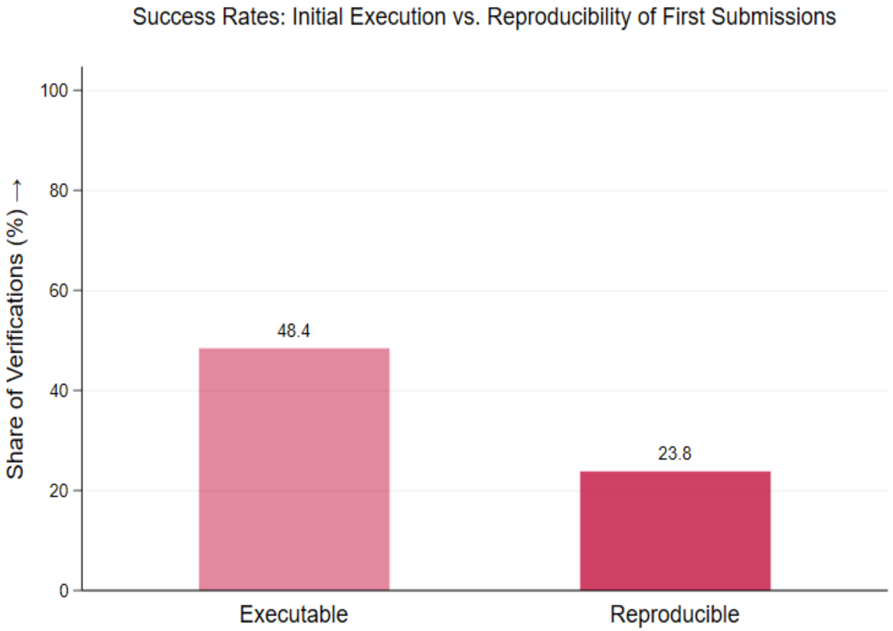
	CA	R&R
Accept	7	24
Accept—with changes	249	0
Conditional accept	62	0
Revise and resubmit	0	3

checks and for the preservation of data for replication packages.

A. *Prepublication Verification of Computational Reproducibility*

The Process

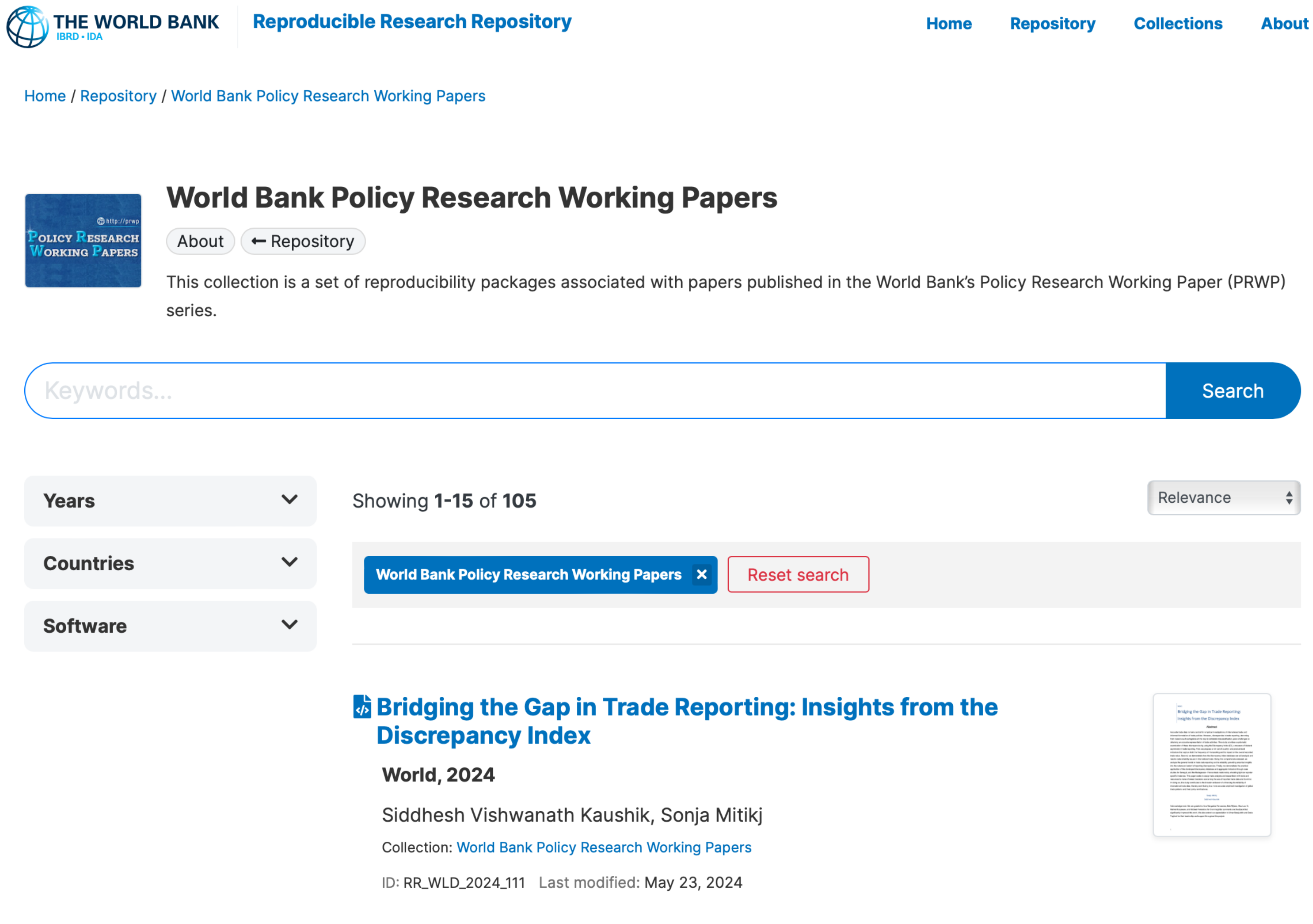
Prepublicaton verification is conducted by the data editor's team at Cornell University. Requests for assessment of reproducibility are received and assigned to a team member who then assesses data availability and compliance with requirements. When some data are available, a full or limited reproducibility check is conducted. If we cannot obtain access to the data



From PRWP verifications:

- Only **1 in 4** of papers pass reproducibility verification on the first try
- About **half** of papers have code that runs successfully on the first try

DIME Analytics Solution: PRWP Verifications



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Reproducible Research Repository

Home Repository Collections About

Home / Repository / World Bank Policy Research Working Papers

World Bank Policy Research Working Papers

About ← Repository

This collection is a set of reproducibility packages associated with papers published in the World Bank's Policy Research Working Paper (PRWP) series.

Keywords... Search

Years
Countries
Software

Showing **1-15** of **105**

Relevance

World Bank Policy Research Working Papers ✕ Reset search

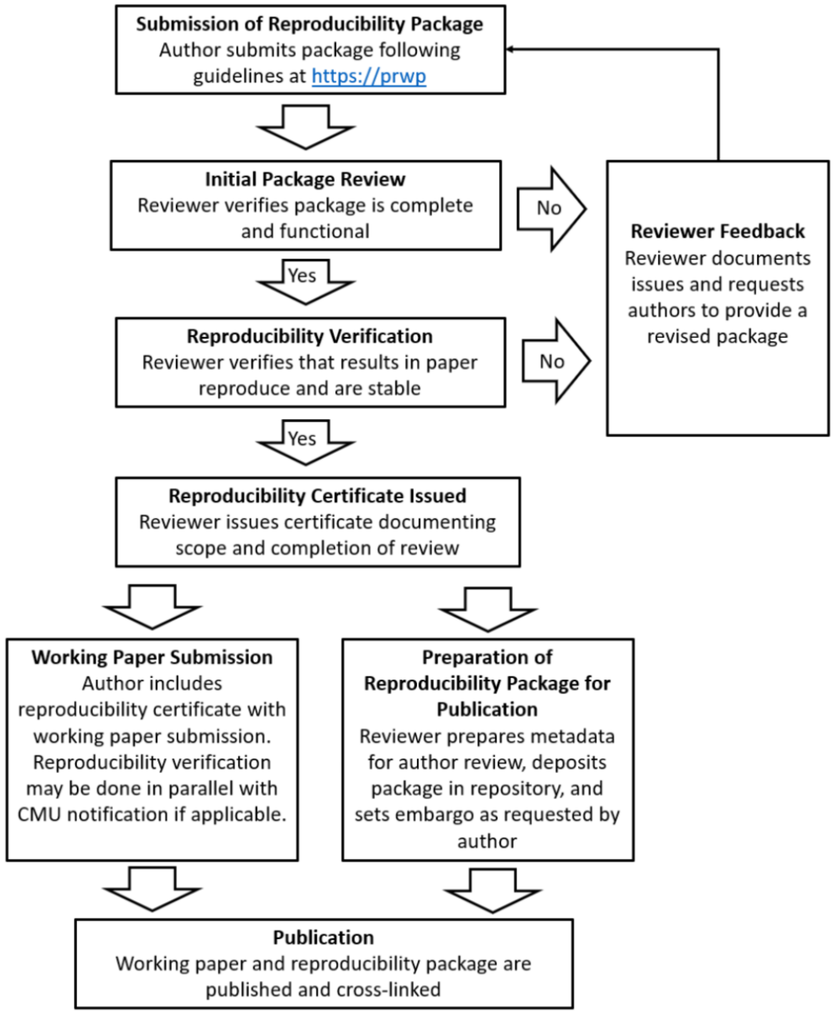
Bridging the Gap in Trade Reporting: Insights from the Discrepancy Index

World, 2024

Siddhesh Vishwanath Kaushik, Sonja Mitikj

Collection: World Bank Policy Research Working Papers

ID: RR_WLD_2024_111 Last modified: May 23, 2024



Submission of Reproducibility Package
Author submits package following guidelines at https://prwp

Initial Package Review
Reviewer verifies package is complete and functional

Reproducibility Verification
Reviewer verifies that results in paper reproduce and are stable

Reviewer Feedback
Reviewer documents issues and requests authors to provide a revised package

Reproducibility Certificate Issued
Reviewer issues certificate documenting scope and completion of review

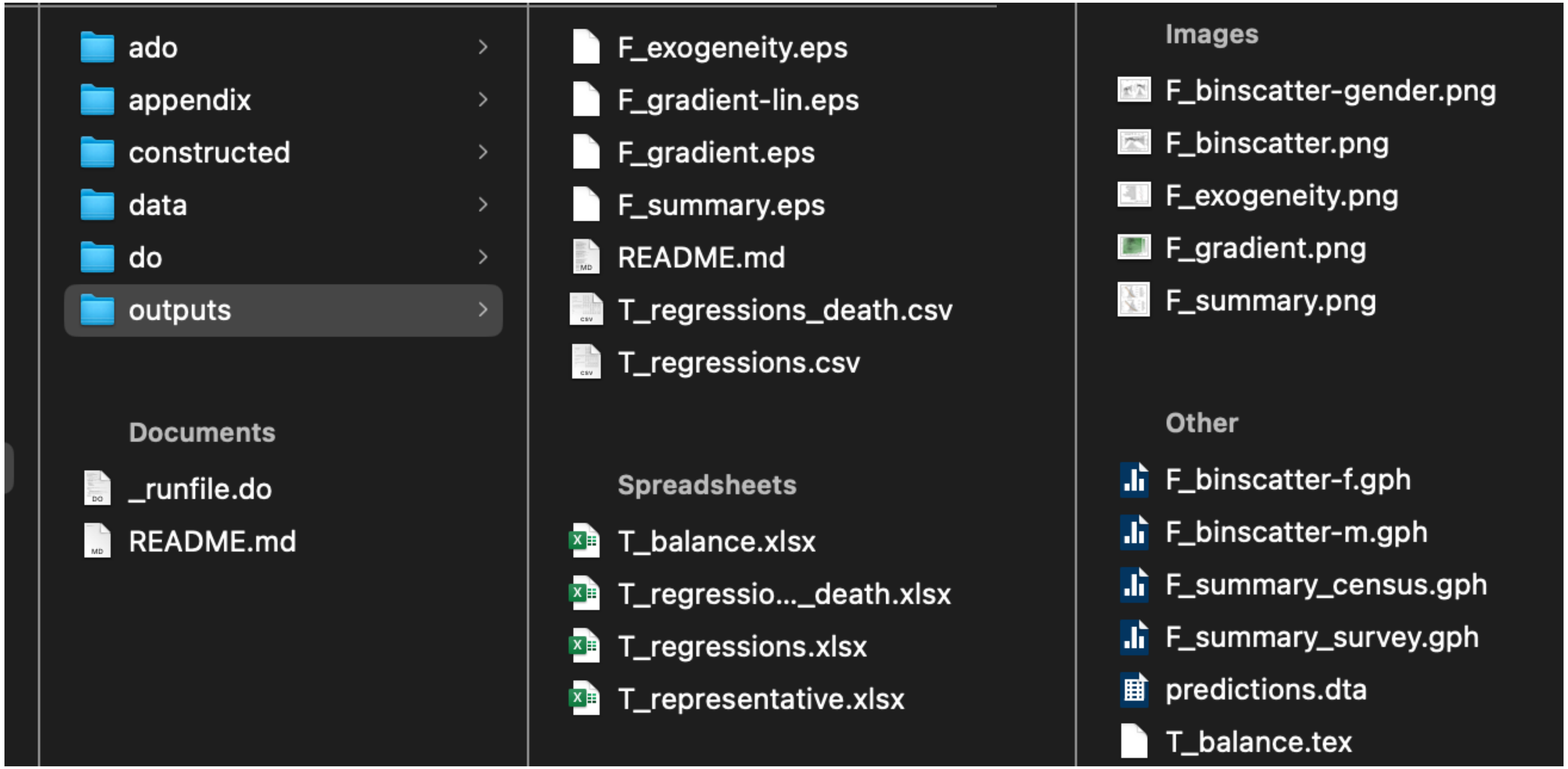
Working Paper Submission
Author includes reproducibility certificate with working paper submission. Reproducibility verification may be done in parallel with CMU notification if applicable.

Preparation of Reproducibility Package for Publication
Reviewer prepares metadata for author review, deposits package in repository, and sets embargo as requested by author

Publication
Working paper and reproducibility package are published and cross-linked

Verifying Reproducibility from Outputs is Slow

- No obvious file format or output structure
- Many non-git-compatible outputs (images)



ado
appendix
constructed
data
do
outputs

Documents
_runfile.do
README.md

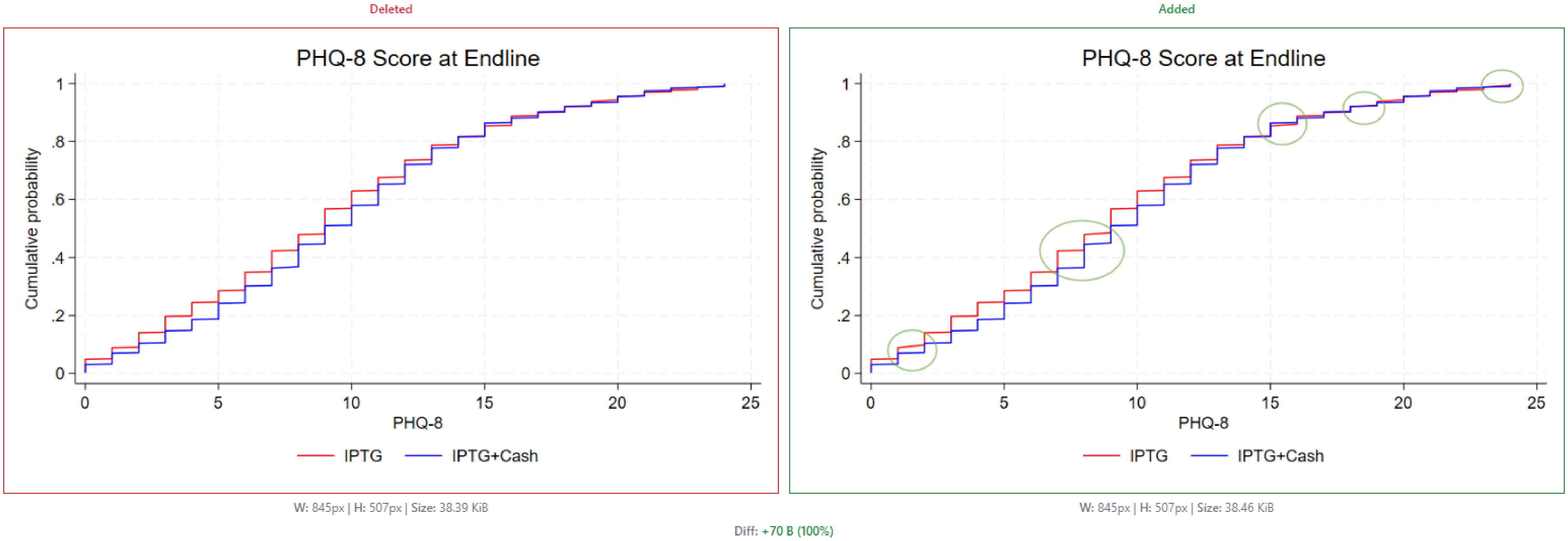
F_exogeneity.eps
F_gradient-lin.eps
F_gradient.eps
F_summary.eps
README.md
T_regressions_death.csv
T_regressions.csv

Spreadsheets
T_balance.xlsx
T_regressio..._death.xlsx
T_regressions.xlsx
T_representative.xlsx

Images
F_binscatter-gender.png
F_binscatter.png
F_exogeneity.png
F_gradient.png
F_summary.png

Other
F_binscatter-f.gph
F_binscatter-m.gph
F_summary_census.gph
F_summary_survey.gph
predictions.dta
T_balance.tex

Spot the differences!



Deleted

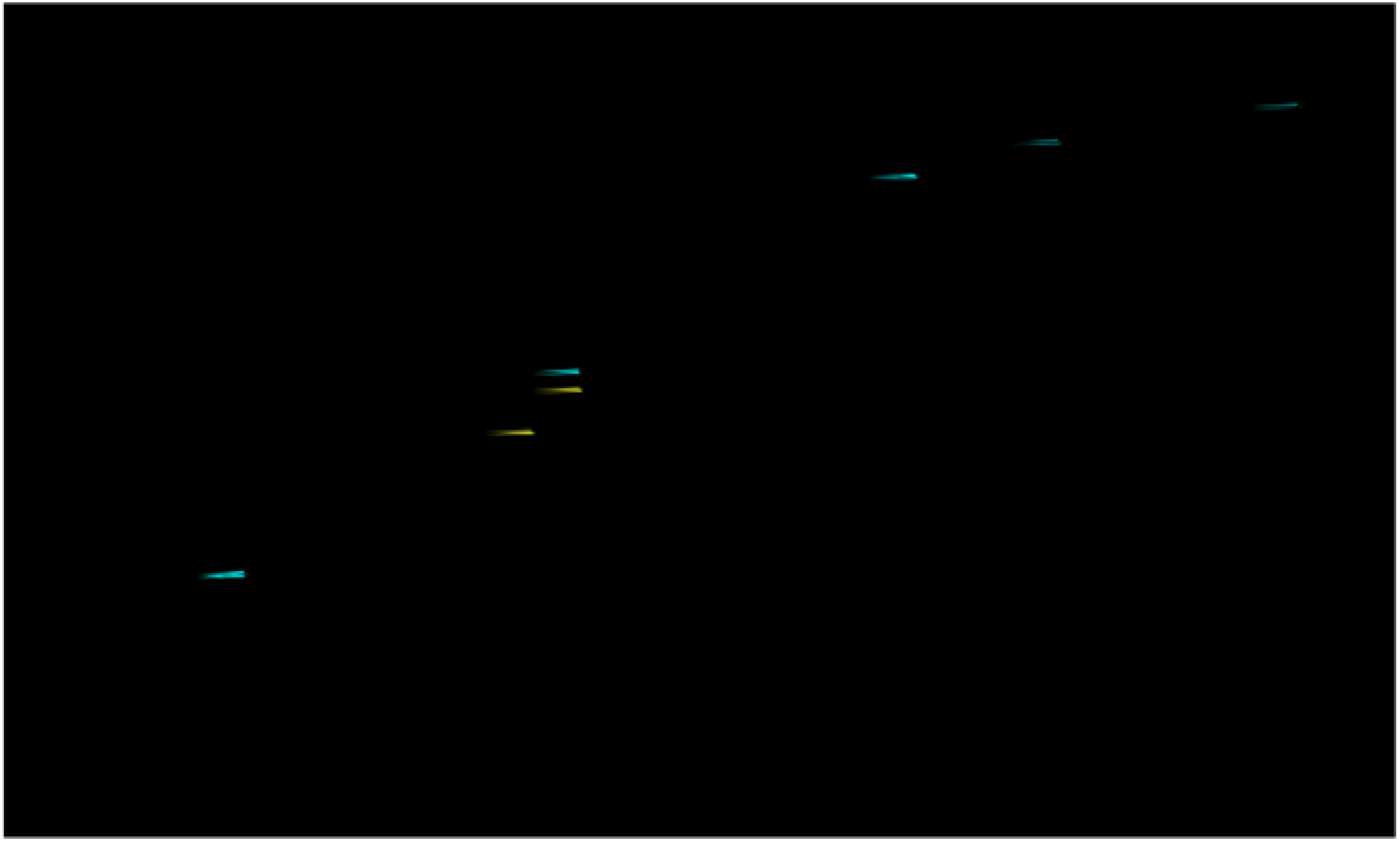
Added

W: 845px | H: 507px | Size: 38.39 KiB

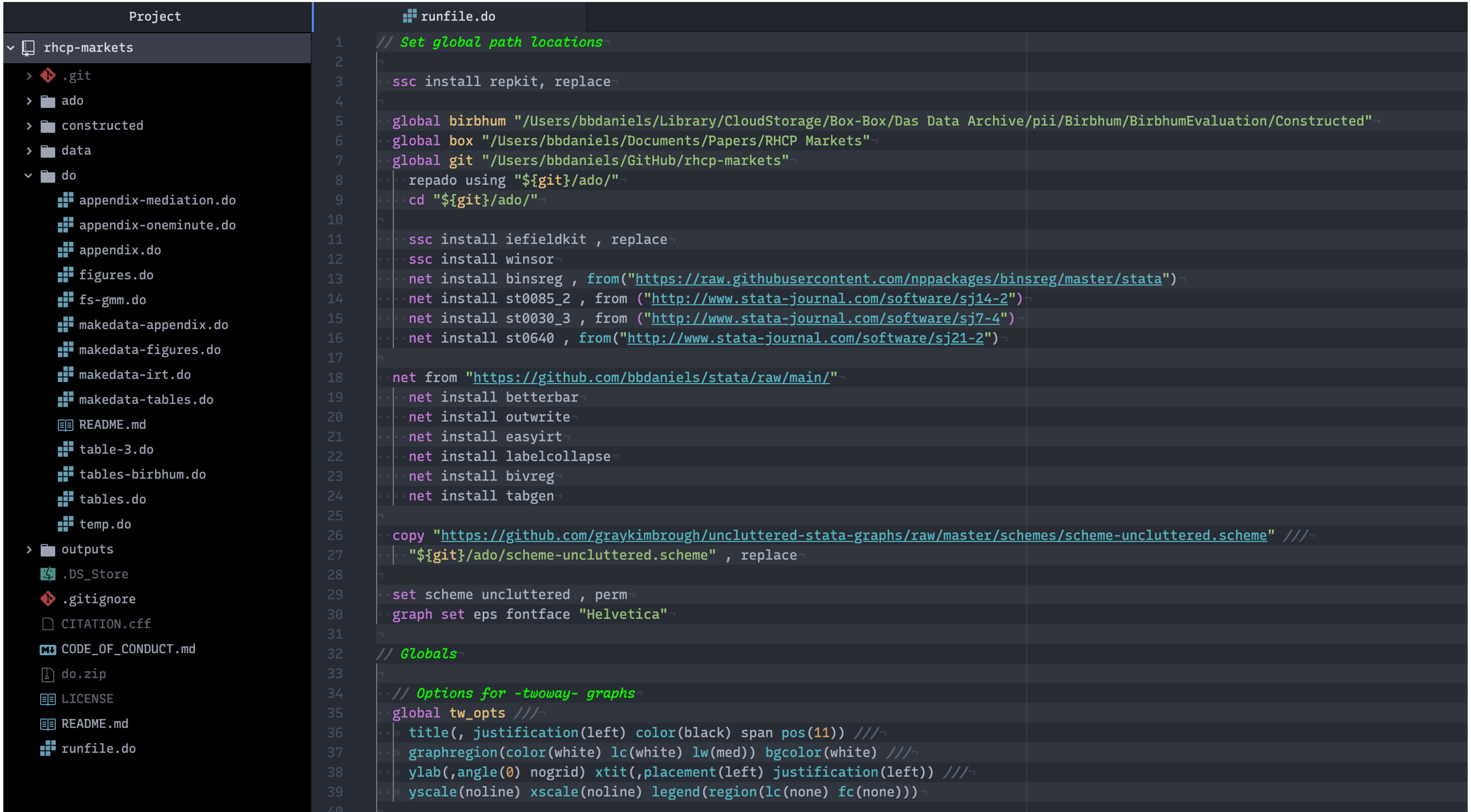
W: 845px | H: 507px | Size: 38.46 KiB

Diff: +70 B (100%)

Not very noticeable… (diff view)



Now… find the cause…



Project

- rhcp-markets
  - .git
  - ado
  - constructed
  - data
  - do
    - appendix-mediation.do
    - appendix-oneminute.do
    - appendix.do
    - figures.do
    - fs-gmm.do
    - makedata-appendix.do
    - makedata-figures.do
    - makedata-irt.do
    - makedata-tables.do
    - README.md
    - table-3.do
    - tables-birbhum.do
    - tables.do
    - temp.do
  - outputs
  - .DS_Store
  - .gitignore
  - CITATION.cff
  - CODE_OF_CONDUCT.md
  - do.zip
  - LICENSE
  - README.md
  - runfile.do

runfile.do

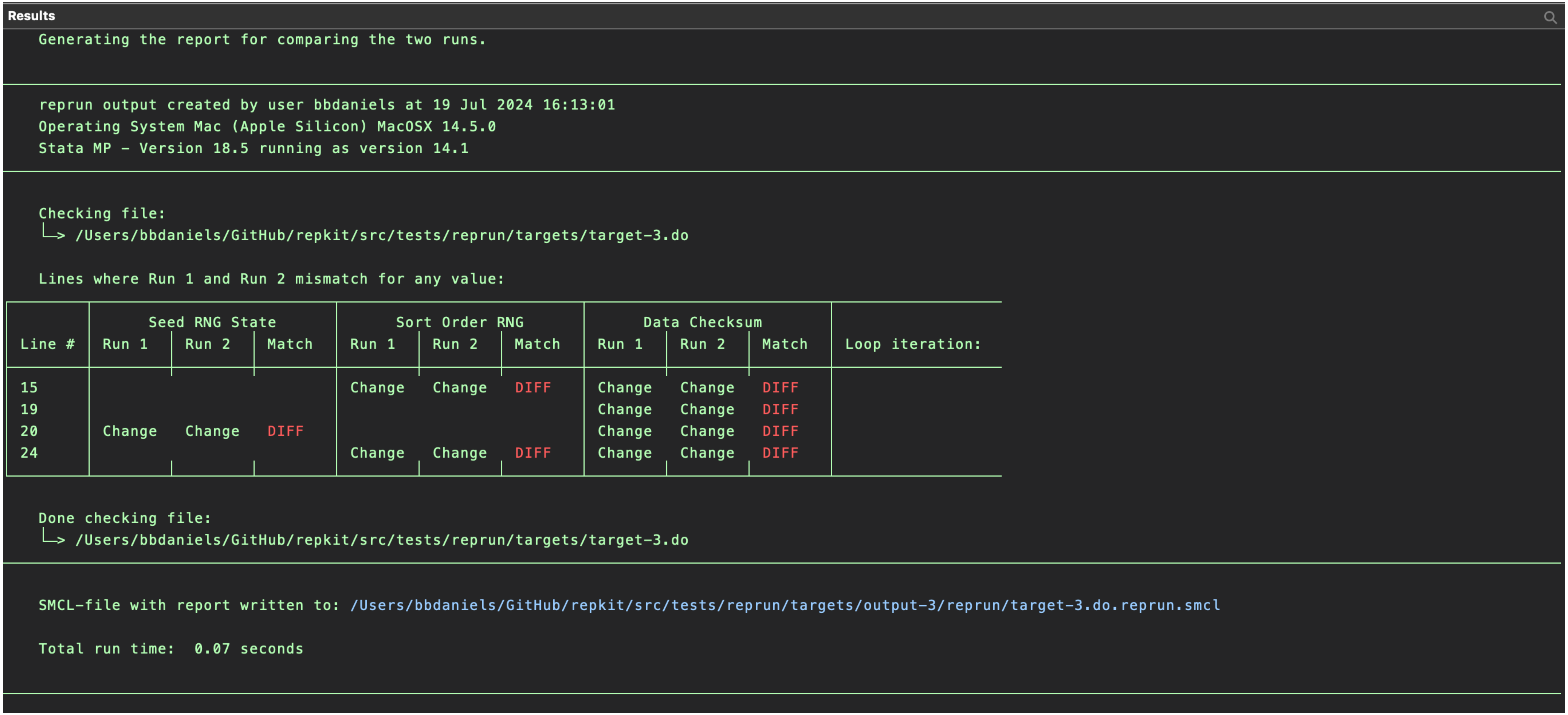
```
// Set global path locations

  ssc install repkit, replace

  global birbhum "/Users/bbdaniels/Library/CloudStorage/Box-Box/Das Data Archive/pii/Birbhum/BirbhumEvaluation/Constructed"
  global box "/Users/bbdaniels/Documents/Papers/RHCP Markets"
  global git "/Users/bbdaniels/GitHub/rhcp-markets"
    repado using "${git}/ado/"
    cd "${git}/ado/"

    ssc install iefieldkit , replace
    ssc install winsor
    net install binsreg , from("https://raw.githubusercontent.com/nppackages/binsreg/master/stata")
    net install st0085_2 , from ("http://www.stata-journal.com/software/sj14-2")
    net install st0030_3 , from ("http://www.stata-journal.com/software/sj7-4")
    net install st0640 , from("http://www.stata-journal.com/software/sj21-2")

  net from "https://github.com/bbdaniels/stata/raw/main/"
    net install betterbar
    net install outwrite
    net install easyirt
    net install labelcollapse
    net install bivreg
    net install tabgen

  copy "https://github.com/graykimbrough/uncluttered-stata-graphs/raw/master/schemes/scheme-uncluttered.scheme" ///
    "${git}/ado/scheme-uncluttered.scheme" , replace

  set scheme uncluttered , perm
  graph set eps fontface "Helvetica"

// Globals

  // Options for -twoway- graphs
  global tw_opts ///
    title(, justification(left) color(black) span pos(11)) ///
    graphregion(color(white) lc(white) lw(med)) bgcolor(white) ///
    ylab(,angle(0) nogrid) xtit(,placement(left) justification(left)) ///
    yscale(noline) xscale(noline) legend(region(lc(none) fc(none)))
```

One big problem

There is no guarantee that the **root cause** of unstable outputs will be anywhere near the output!

Could be in data construction many files back, for example.

(re)Introducing `reprun`

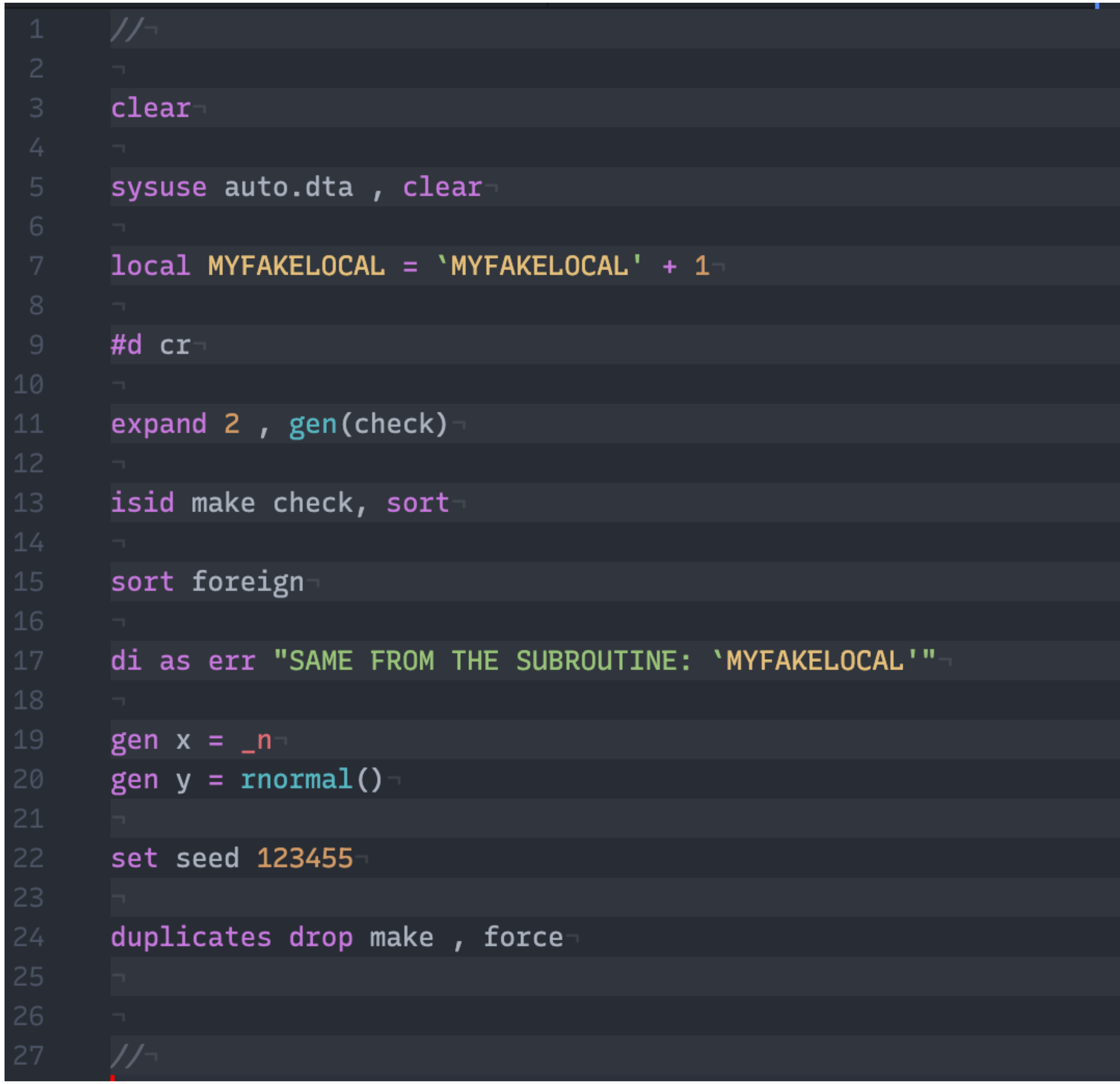


```
   Generating the report for comparing the two runs.

 ------------------------------------------------------------------------------------------------------------------------------------

   reprun output created by user bbdaniels at 19 Jul 2024 16:13:01
   Operating System Mac (Apple Silicon) MacOSX 14.5.0
   Stata MP - Version 18.5 running as version 14.1

 ------------------------------------------------------------------------------------------------------------------------------------


   Checking file:
   └─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-3.do

   Lines where Run 1 and Run 2 mismatch for any value:
 ┌────────┬──────────────────────────┬──────────────────────────┬──────────────────────────┬──────────────────
 │        │      Seed RNG State      │      Sort Order RNG      │      Data Checksum       │
 │ Line # │ Run 1    Run 2    Match  │ Run 1    Run 2    Match  │ Run 1    Run 2    Match  │ Loop iteration:
 ├────────┼──────────────────────────┼──────────────────────────┼──────────────────────────┼──────────────────
 │ 15     │                          │ Change   Change   DIFF   │ Change   Change   DIFF   │
 │ 19     │                          │                          │ Change   Change   DIFF   │
 │ 20     │ Change   Change   DIFF   │                          │ Change   Change   DIFF   │
 │ 24     │                          │ Change   Change   DIFF   │ Change   Change   DIFF   │
 └────────┴──────────────────────────┴──────────────────────────┴──────────────────────────┴──────────────────

   Done checking file:
   └─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-3.do

 ------------------------------------------------------------------------------------------------------------------------------------

   SMCL-file with report written to: /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/output-3/reprun/target-3.do.reprun.smcl

   Total run time:  0.07 seconds

 ------------------------------------------------------------------------------------------------------------------------------------
```

Here’s how it works

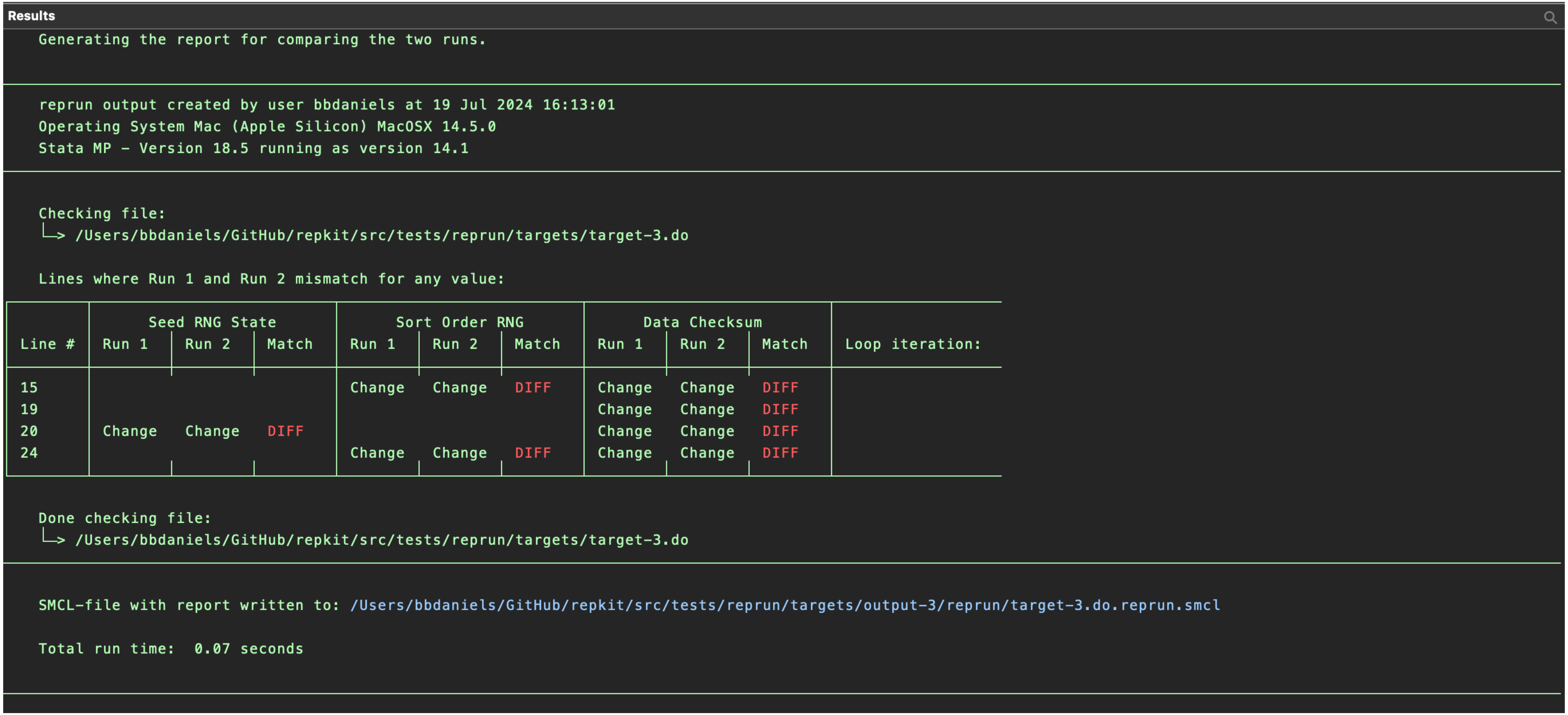
- Two basic problems that lead to all others:
  - Unset seed
  - Unstable sort

- We detect them by comparing the RNG state and the sort RNG state after EVERY line
- We then get a data checksum
- Then we do it again



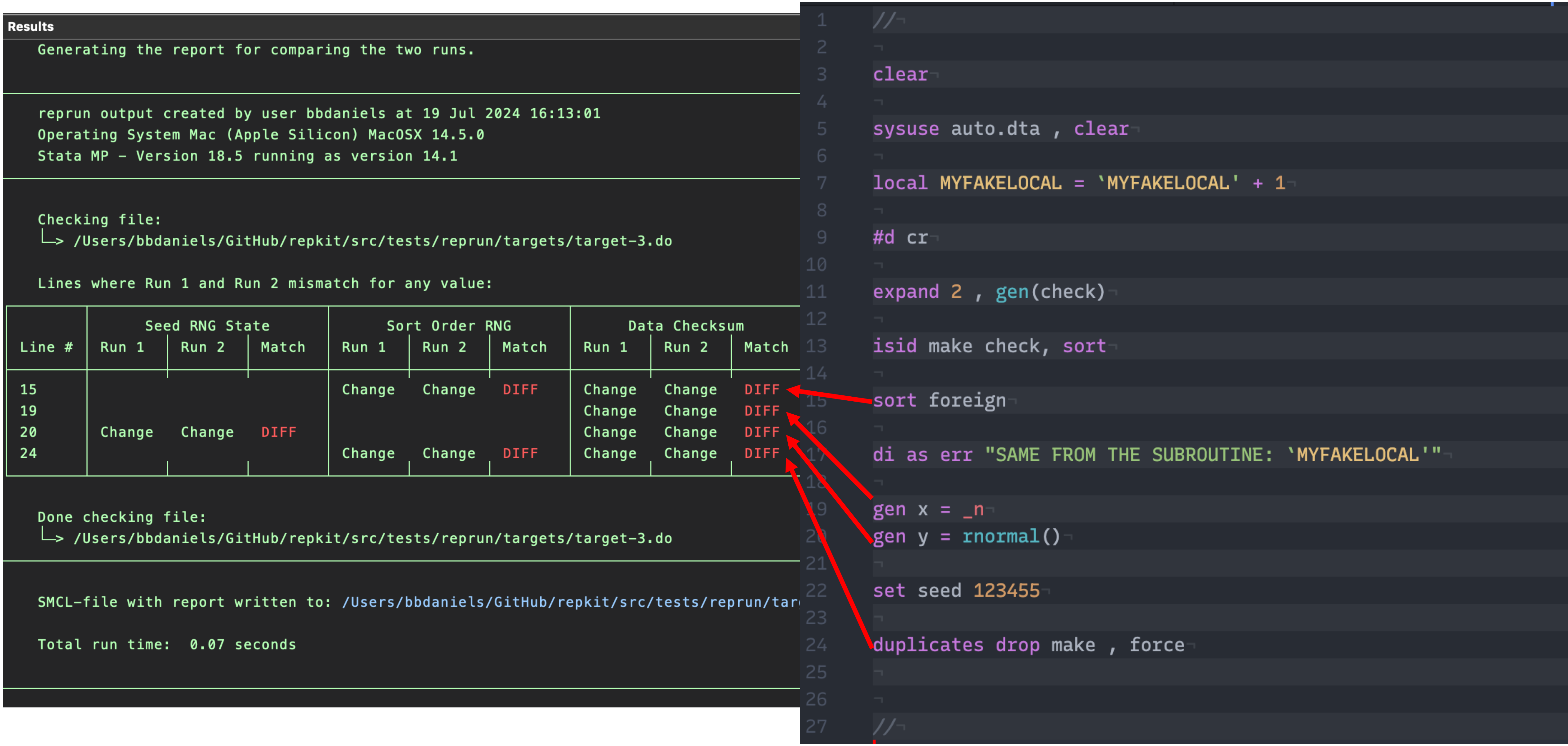
```
//

clear

sysuse auto.dta , clear

local MYFAKELOCAL = `MYFAKELOCAL' + 1

#d cr

expand 2 , gen(check)

isid make check, sort

sort foreign

di as err "SAME FROM THE SUBROUTINE: `MYFAKELOCAL'"

gen x = _n
gen y = rnormal()

set seed 123455

duplicates drop make , force


//
```

(re)Introducing reprun



```
  Generating the report for comparing the two runs.

─────────────────────────────────────────────────────────────────────────────────────────────────────────────────

  reprun output created by user bbdaniels at 19 Jul 2024 16:13:01
  Operating System Mac (Apple Silicon) MacOSX 14.5.0
  Stata MP - Version 18.5 running as version 14.1

─────────────────────────────────────────────────────────────────────────────────────────────────────────────────


  Checking file:
  └─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-3.do

  Lines where Run 1 and Run 2 mismatch for any value:
─────────────────────────────────────────────────────────────────────────────────────────────────────────────
│        │      Seed RNG State      │      Sort Order RNG      │      Data Checksum       │                  
│ Line # │ Run 1  │ Run 2  │ Match  │ Run 1  │ Run 2  │ Match  │ Run 1  │ Run 2  │ Match  │ Loop iteration:  
─────────────────────────────────────────────────────────────────────────────────────────────────────────────
│ 15     │        │        │        │ Change │ Change │ DIFF   │ Change │ Change │ DIFF   │
│ 19     │        │        │        │        │        │        │ Change │ Change │ DIFF   │
│ 20     │ Change │ Change │ DIFF   │        │        │        │ Change │ Change │ DIFF   │
│ 24     │        │        │        │ Change │ Change │ DIFF   │ Change │ Change │ DIFF   │
─────────────────────────────────────────────────────────────────────────────────────────────────────────────

  Done checking file:
  └─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-3.do

─────────────────────────────────────────────────────────────────────────────────────────────────────────────────

  SMCL-file with report written to: /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/output-3/reprun/target-3.do.reprun.smcl

  Total run time:  0.07 seconds

─────────────────────────────────────────────────────────────────────────────────────────────────────────────────
```

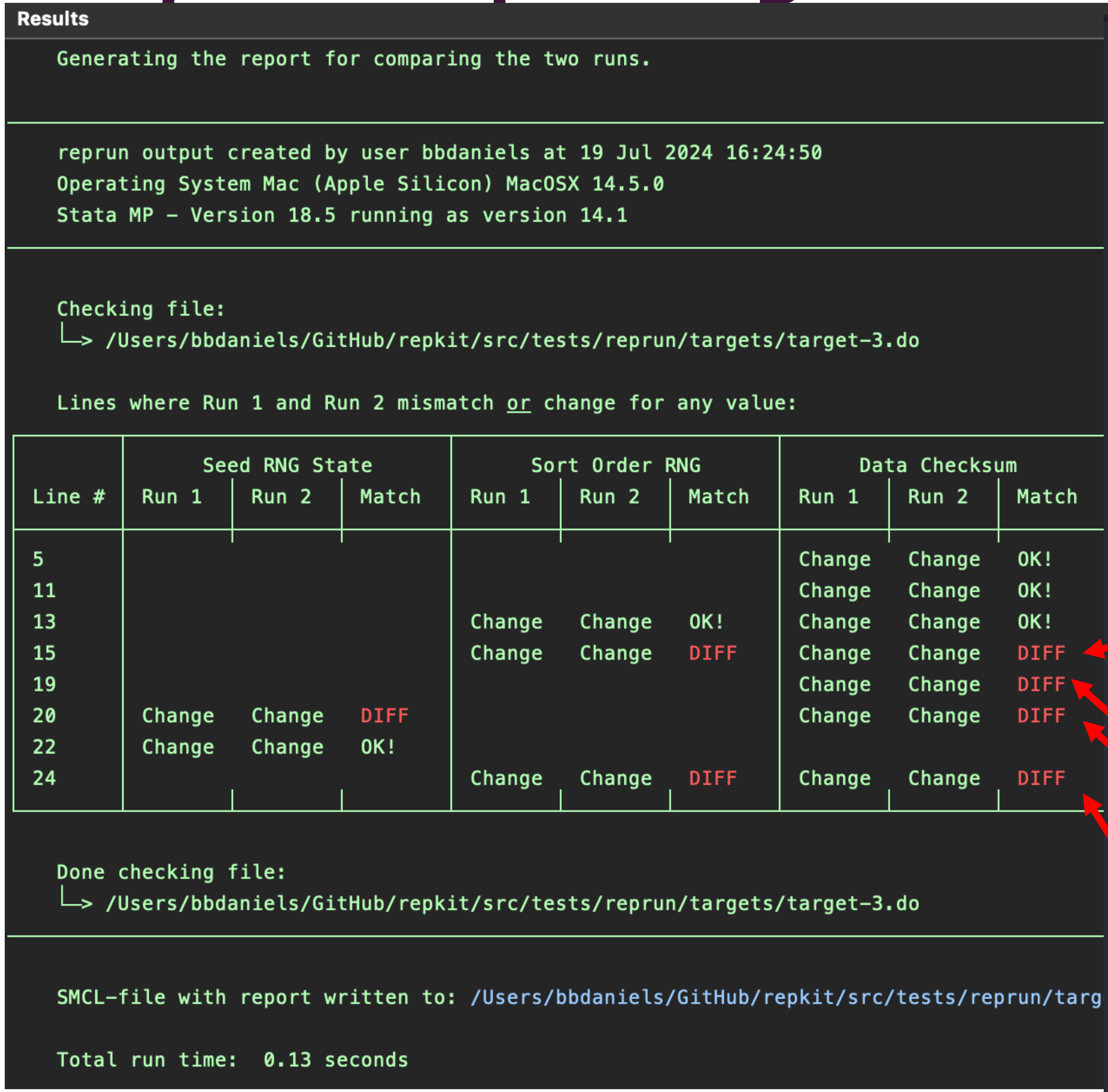
(re)Introducing **reprun**



```
Results
    Generating the report for comparing the two runs.

    reprun output created by user bbdaniels at 19 Jul 2024 16:13:01
    Operating System Mac (Apple Silicon) MacOSX 14.5.0
    Stata MP - Version 18.5 running as version 14.1


    Checking file:
    └─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-3.do

    Lines where Run 1 and Run 2 mismatch for any value:

 |        |     Seed RNG State        |     Sort Order RNG        |     Data Checksum         |
 | Line # | Run 1  | Run 2  | Match   | Run 1  | Run 2  | Match   | Run 1  | Run 2  | Match   |
 |--------+--------+--------+---------+--------+--------+---------+--------+--------+---------|
 | 15     |        |        |         | Change | Change | DIFF    | Change | Change | DIFF    |
 | 19     |        |        |         |        |        |         | Change | Change | DIFF    |
 | 20     | Change | Change | DIFF    |        |        |         | Change | Change | DIFF    |
 | 24     |        |        |         | Change | Change | DIFF    | Change | Change | DIFF    |

    Done checking file:
    └─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-3.do


    SMCL-file with report written to: /Users/bbdaniels/GitHub/repkit/src/tests/reprun/tar

    Total run time:  0.07 seconds
```

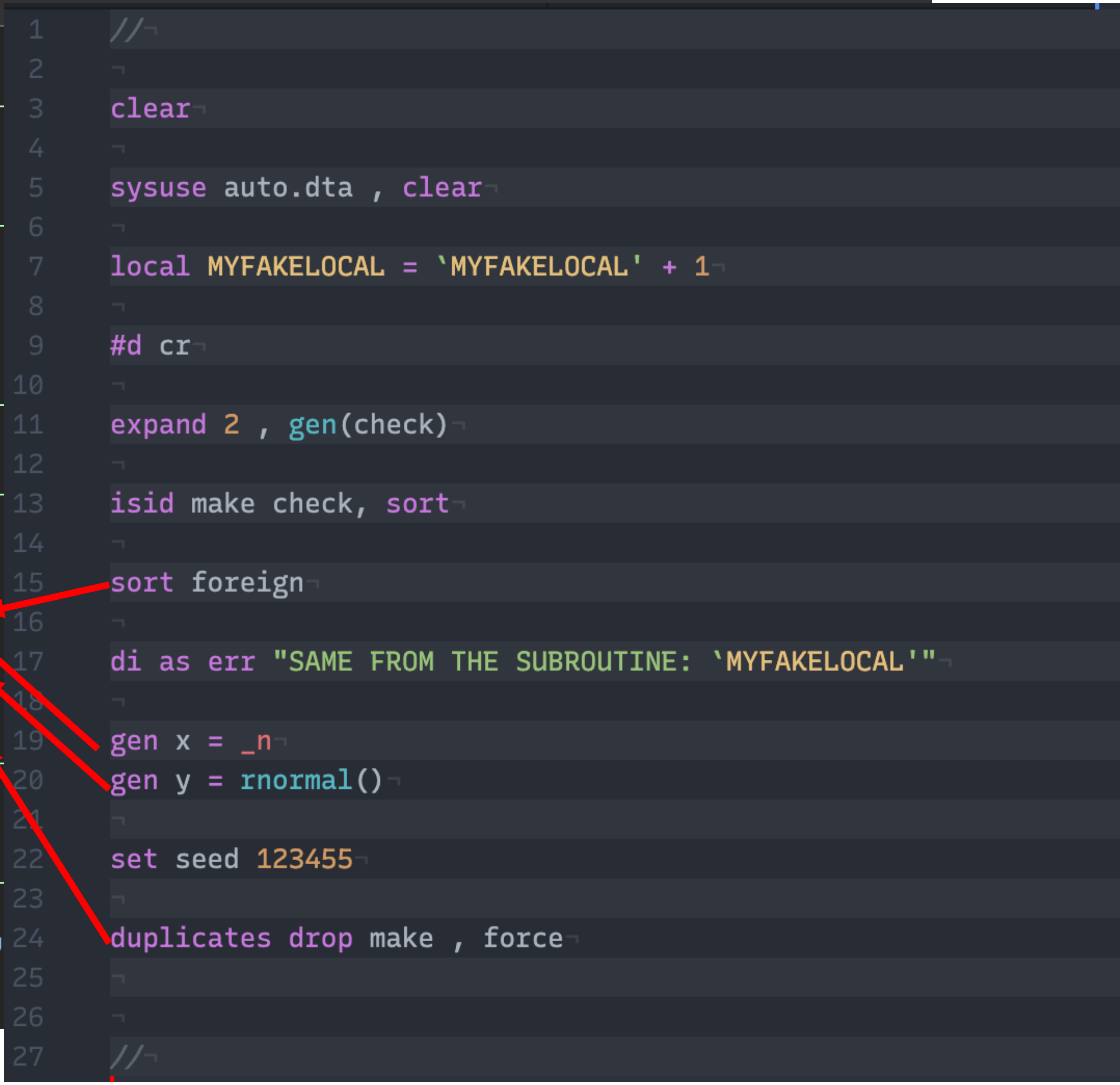
```
1   //
2
3   clear
4
5   sysuse auto.dta , clear
6
7   local MYFAKELOCAL = `MYFAKELOCAL' + 1
8
9   #d cr
10
11  expand 2 , gen(check)
12
13  isid make check, sort
14
15  sort foreign
16
17  di as err "SAME FROM THE SUBROUTINE: `MYFAKELOCAL'"
18
19  gen x = _n
20  gen y = rnormal()
21
22  set seed 123455
23
24  duplicates drop make , force
25
26
27  //
```

Complete reporting with [reprun , verbose]



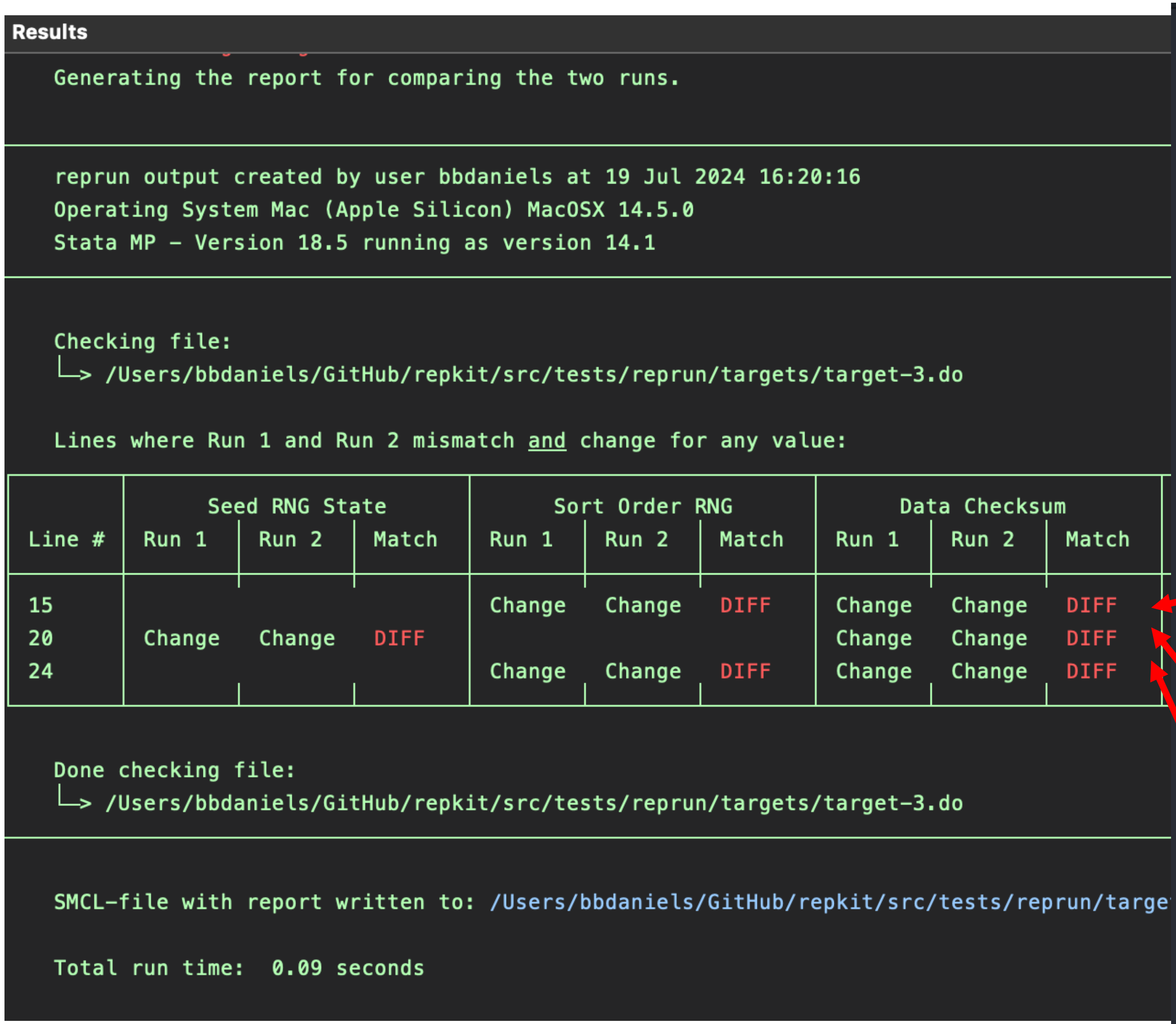
Results

```
  Generating the report for comparing the two runs.

  reprun output created by user bbdaniels at 19 Jul 2024 16:24:50
  Operating System Mac (Apple Silicon) MacOSX 14.5.0
  Stata MP - Version 18.5 running as version 14.1

  Checking file:
  └─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-3.do

  Lines where Run 1 and Run 2 mismatch or change for any value:

|        |    Seed RNG State     |    Sort Order RNG     |    Data Checksum      |
| Line # | Run 1   Run 2   Match | Run 1   Run 2   Match | Run 1   Run 2   Match |
|        |                       |                       |                       |
| 5      |                       |                       | Change  Change  OK!   |
| 11     |                       |                       | Change  Change  OK!   |
| 13     |                       | Change  Change  OK!   | Change  Change  OK!   |
| 15     |                       | Change  Change  DIFF  | Change  Change  DIFF  |
| 19     |                       |                       | Change  Change  DIFF  |
| 20     | Change  Change  DIFF  |                       | Change  Change  DIFF  |
| 22     | Change  Change  OK!   |                       |                       |
| 24     |                       | Change  Change  DIFF  | Change  Change  DIFF  |

  Done checking file:
  └─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-3.do

  SMCL-file with report written to: /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targ

  Total run time:  0.13 seconds
```

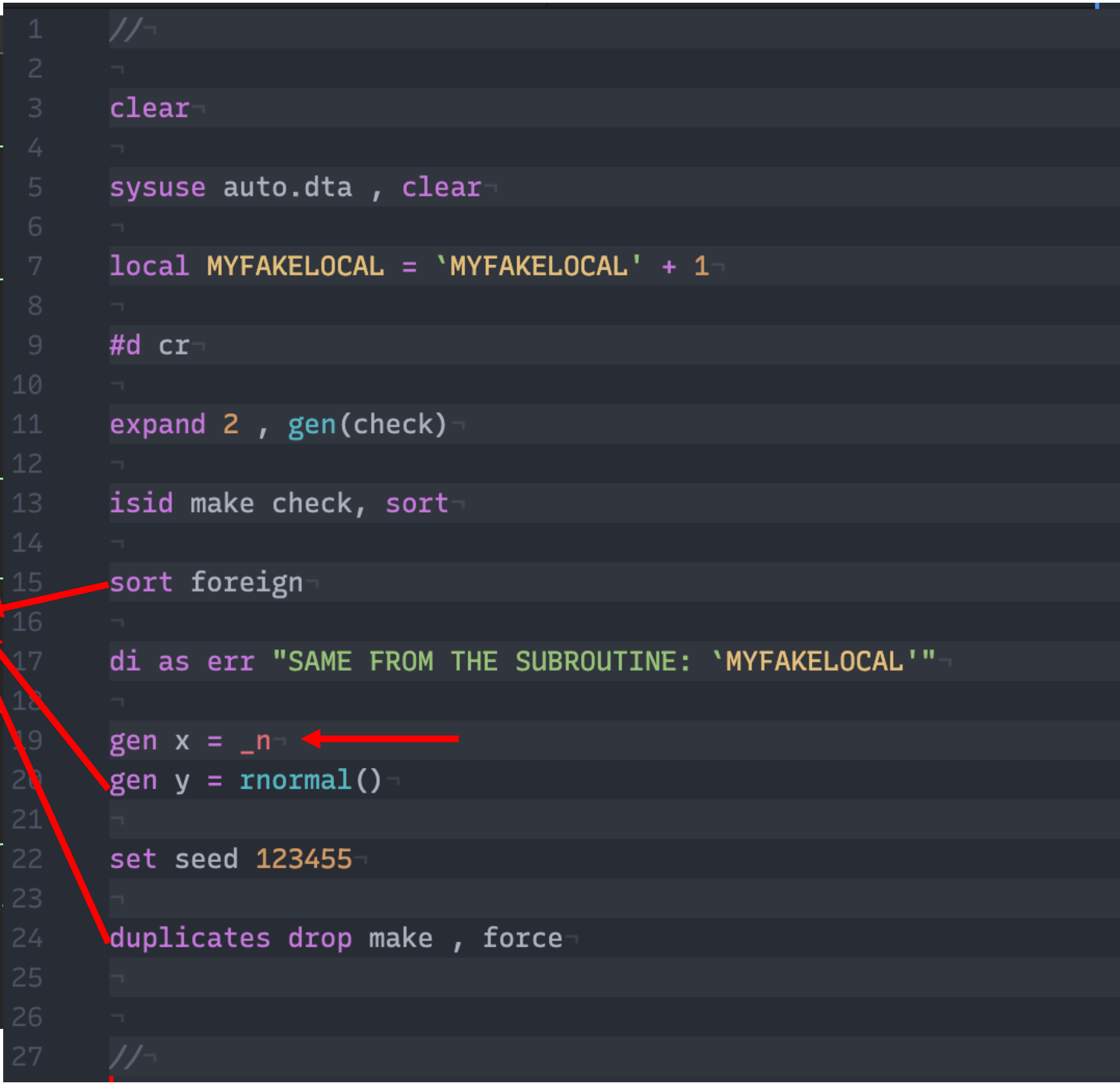


```
1   //
2
3   clear
4
5   sysuse auto.dta , clear
6
7   local MYFAKELOCAL = ‘MYFAKELOCAL' + 1
8
9   #d cr
10
11  expand 2 , gen(check)
12
13  isid make check, sort
14
15  sort foreign
16
17  di as err "SAME FROM THE SUBROUTINE: ‘MYFAKELOCAL'"
18
19  gen x = _n
20  gen y = rnormal()
21
22  set seed 123455
23
24  duplicates drop make , force
25
26
27  //
```

Issue-targeted reporting with [reprun ,compact]

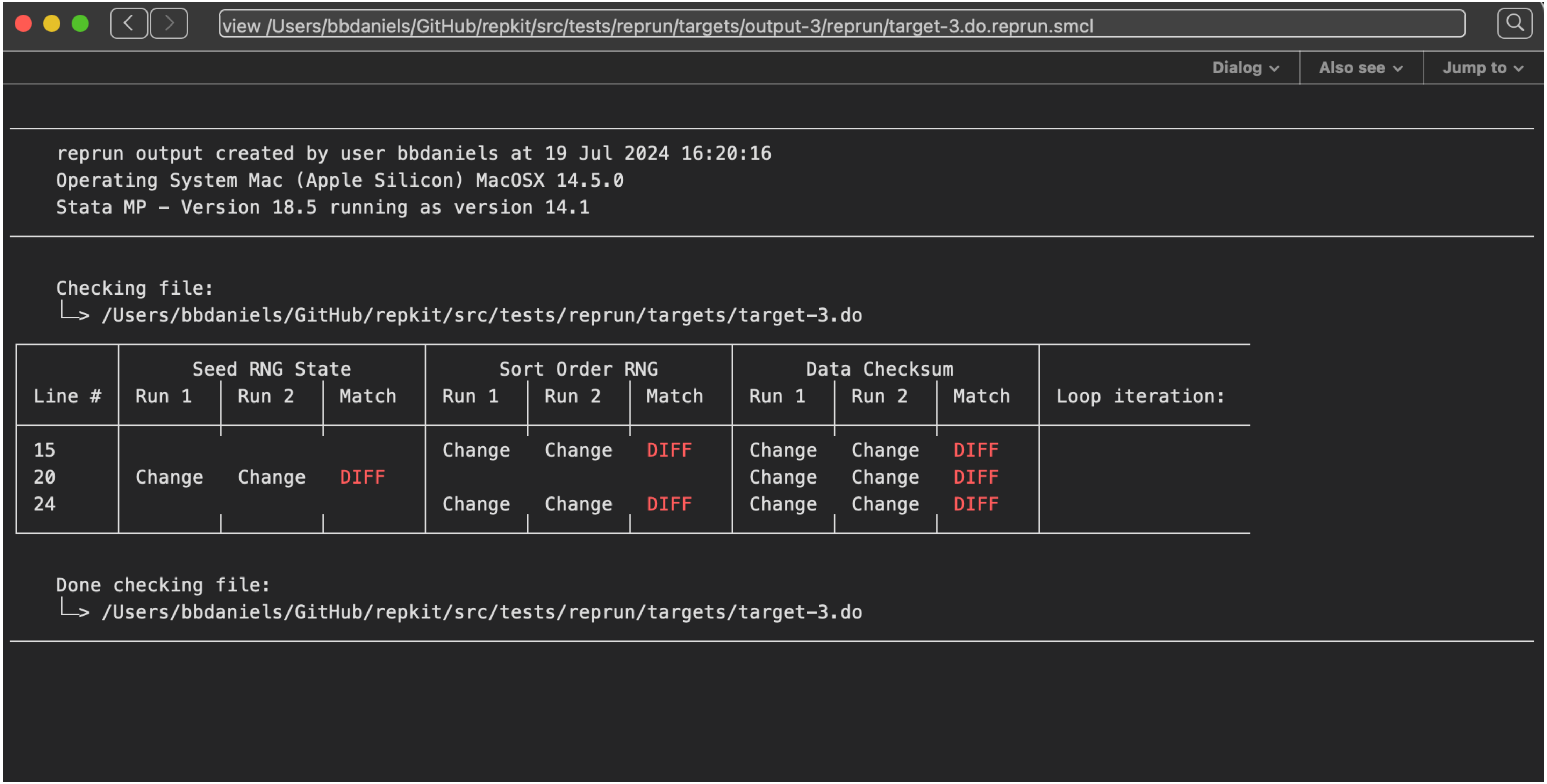


```
  Generating the report for comparing the two runs.

  ─────────────────────────────────────────────────────────────────────

  reprun output created by user bbdaniels at 19 Jul 2024 16:20:16
  Operating System Mac (Apple Silicon) MacOSX 14.5.0
  Stata MP - Version 18.5 running as version 14.1

  ─────────────────────────────────────────────────────────────────────

  Checking file:
  └─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-3.do

  Lines where Run 1 and Run 2 mismatch and change for any value:

┌────────┬──────────────────────────┬──────────────────────────┬──────────────────────────┐
│        │      Seed RNG State      │      Sort Order RNG      │      Data Checksum       │
│ Line # │ Run 1    Run 2    Match  │ Run 1    Run 2    Match  │ Run 1    Run 2    Match  │
├────────┼──────────────────────────┼──────────────────────────┼──────────────────────────┤
│ 15     │                          │ Change   Change   DIFF   │ Change   Change   DIFF   │
│ 20     │ Change   Change   DIFF   │                          │ Change   Change   DIFF   │
│ 24     │                          │ Change   Change   DIFF   │ Change   Change   DIFF   │
└────────┴──────────────────────────┴──────────────────────────┴──────────────────────────┘

  Done checking file:
  └─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-3.do

  ─────────────────────────────────────────────────────────────────────

  SMCL-file with report written to: /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targe

  Total run time:  0.09 seconds
```



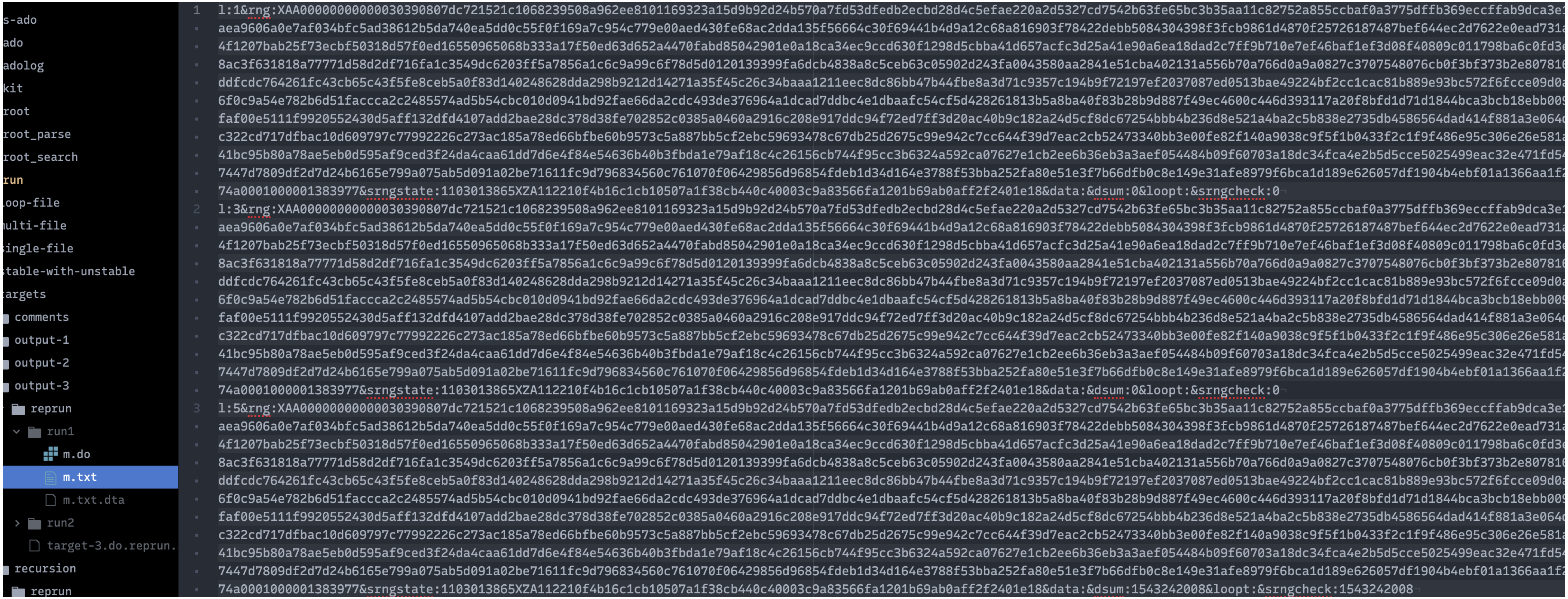
```
1   //
2
3   clear
4
5   sysuse auto.dta , clear
6
7   local MYFAKELOCAL = ‘MYFAKELOCAL' + 1
8
9   #d cr
10
11  expand 2 , gen(check)
12
13  isid make check, sort
14
15  sort foreign
16
17  di as err "SAME FROM THE SUBROUTINE: ‘MYFAKELOCAL'"
18
19  gen x = _n
20  gen y = rnormal()
21
22  set seed 123455
23
24  duplicates drop make , force
25
26
27  //
```

SMCL / git-trackable output logs


view /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/output-3/reprun/target-3.do.reprun.smcl
Dialog
Also see
Jump to

```
-----------------------------------------------------------------------------------------------------------------------

    reprun output created by user bbdaniels at 19 Jul 2024 16:20:16
    Operating System Mac (Apple Silicon) MacOSX 14.5.0
    Stata MP - Version 18.5 running as version 14.1

-----------------------------------------------------------------------------------------------------------------------


    Checking file:
    └> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-3.do

 |--------|--------------------------|--------------------------|--------------------------|------------------
 |        |      Seed RNG State      |      Sort Order RNG      |      Data Checksum       |
 | Line # | Run 1  | Run 2  | Match  | Run 1  | Run 2  | Match  | Run 1  | Run 2  | Match  | Loop iteration:
 |--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------------------
 | 15     |        |        |        | Change | Change | DIFF   | Change | Change | DIFF   |
 | 20     | Change | Change | DIFF   |        |        |        | Change | Change | DIFF   |
 | 24     |        |        |        | Change | Change | DIFF   | Change | Change | DIFF   |
 |--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------------------

    Done checking file:
    └> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-3.do

-----------------------------------------------------------------------------------------------------------------------
```

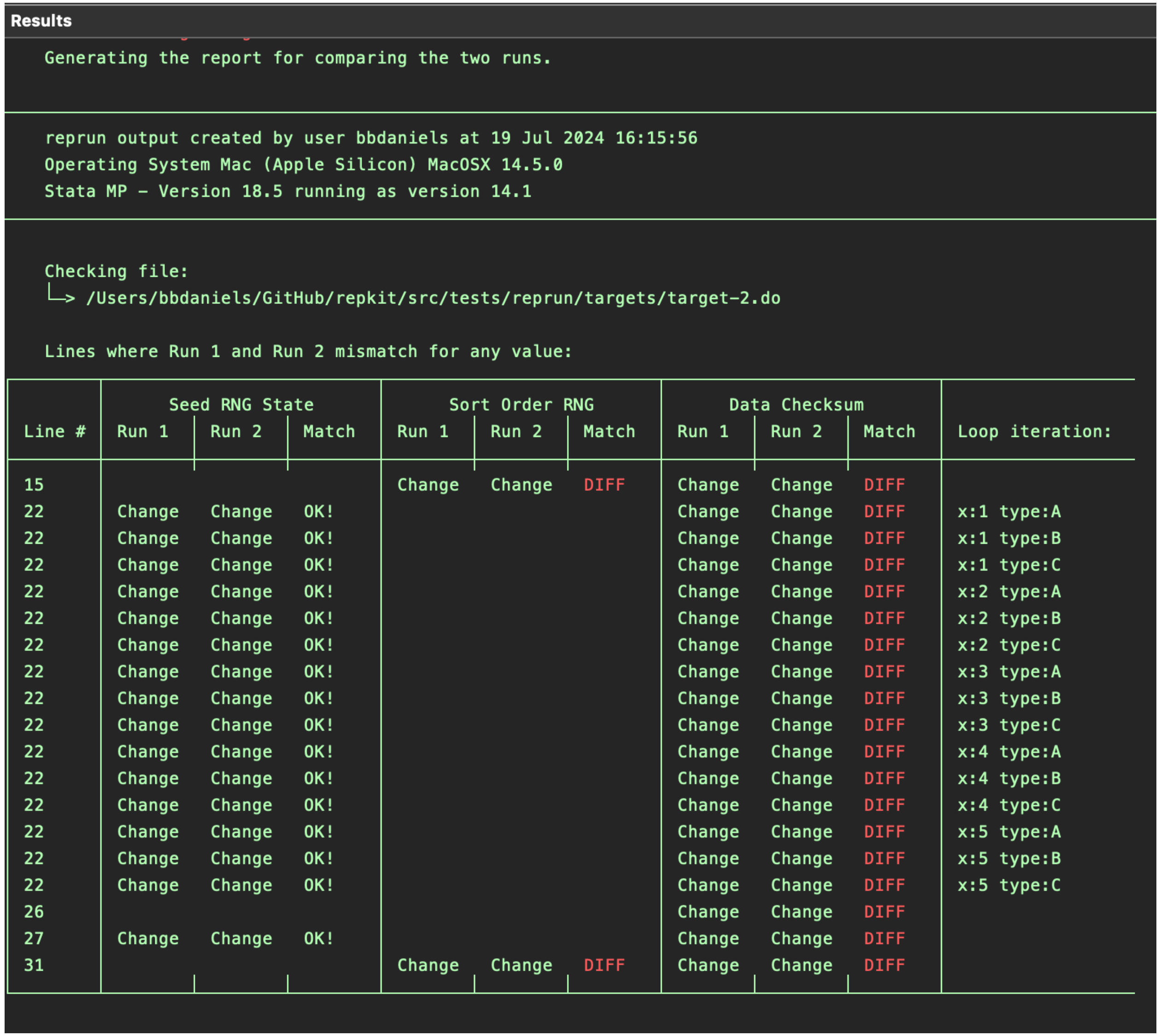
Debuggable – see exact Stata state line-by-line (you shouldn’t need this but we do)



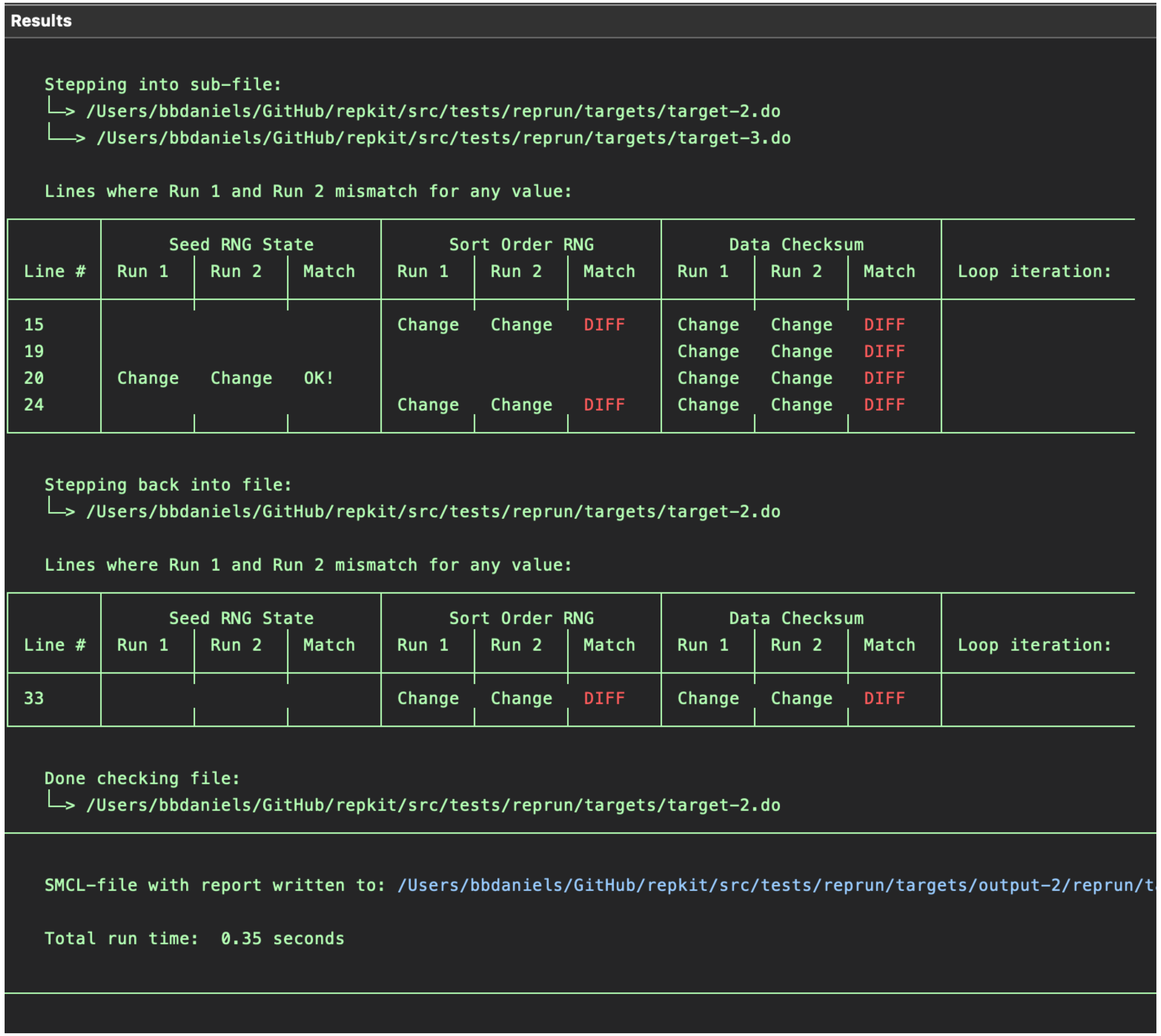
```
s-ado
ado
adolog
kit
root
root_parse
root_search
run
oop-file
ulti-file
ingle-file
table-with-unstable
argets
 comments
 output-1
 output-2
 output-3
   reprun
     run1
       m.do
       m.txt
       m.txt.dta
     run2
     target-3.do.reprun.
 recursion
   reprun
```

```
l:1&rng:XAA0000000000030390807dc721521c1068239508a962ee8101169323a15d9b92d24b570a7fd53dfedb2ecbd28d4c5efae220a2d5327cd7542b63fe65bc3b35aa11c82752a855ccbaf0a3775dffb369eccffab9dca3e
aea9606a0e7af034bfc5ad38612b5da740ea5dd0c55f0f169a7c954c779e00aed430fe68ac2dda135f56664c30f69441b4d9a12c68a816903f78422debb508304398f3fcb9861d4870f25726187487bef644ec2d7622e0ead731a
4f1207bab25f73ecbf50318d57f0ed16550965068b333a17f50ed63d652a4470fabd85042901e0a18ca34ec9ccd630f1298d5cbba41d657acfc3d25a41e90a6ea18dad2c7ff9b710e7ef46baf1ef3d08f40809c011798ba6c0fd3e
8ac3f631818a77771d58d2df716fa1c3549dc6203ff5a7856a1c6c9a99c6f78d5d0120139399fa6dcb4838a8c5ceb63c05902d243fa0043580aa2841e51cba402131a556b70a766d0a9a0827c3707548076cb0f3bf373b2e807816
ddfcdc764261fc43cb65c43f5fe8ceb5a0f83d140248628dda298b9212d14271a35f45c26c34baaa1211eec8dc86bb47b44fbe8a3d71c9357c194b9f72197ef2037087ed0513bae49224bf2cc1cac81b889e93bc572f6fcce09d0a
6f0c9a54e782b6d51faccca2c2485574ad5b54cbc010d0941bd92fae66da2cdc493de376964a1dcad7ddbc4e1dbaafc54cf5d428261813b5a8ba40f83b28b9d887f49ec4600c446d393117a20f8bfd1d71d1844bca3bcb18ebb009
faf00e5111f9920552430d5aff132dfd4107add2bae28dc378d38fe702852c0385a0460a2916c208e917ddc94f72ed7ff3d20ac40b9c182a24d5cf8dc67254bbb4b236d8e521a4ba2c5b838e2735db4586564dad414f881a3e064
c322cd717dfbac10d609797c77992226c273ac185a78ed66bfbe60b9573c5a887bb5cf2ebc59693478c67db25d2675c99e942c7cc644f39d7eac2cb52473340bb3e00fe82f140a9038c9f5f1b0433f2c1f9f486e95c306e26e581a
41bc95b80a78ae5eb0d595af9ced3f24da4caa61dd7d6e4f84e54636b40b3fbda1e79af18c4c26156cb744f95cc3b6324a592ca07627e1cb2ee6b36eb3a3aef054484b09f60703a18dc34fca4e2b5d5cce5025499eac32e471fd54
7447d7809df2d7d24b6165e799a075ab5d091a02be71611fc9d796834560c761070f06429856d96854fdeb1d34d164e3788f53bba252fa80e51e3f7b66dfb0c8e149e31afe8979f6bca1d189e626057df1904b4ebf01a1366aa1f2
74a0001000001383977&srngstate:1103013865XZA112210f4b16c1cb10507a1f38cb440c40003c9a83566fa1201b69ab0aff2f2401e18&data:&dsum:0&loopt:&srngcheck:0
l:3&rng:XAA0000000000030390807dc721521c1068239508a962ee8101169323a15d9b92d24b570a7fd53dfedb2ecbd28d4c5efae220a2d5327cd7542b63fe65bc3b35aa11c82752a855ccbaf0a3775dffb369eccffab9dca3e
aea9606a0e7af034bfc5ad38612b5da740ea5dd0c55f0f169a7c954c779e00aed430fe68ac2dda135f56664c30f69441b4d9a12c68a816903f78422debb508304398f3fcb9861d4870f25726187487bef644ec2d7622e0ead731a
4f1207bab25f73ecbf50318d57f0ed16550965068b333a17f50ed63d652a4470fabd85042901e0a18ca34ec9ccd630f1298d5cbba41d657acfc3d25a41e90a6ea18dad2c7ff9b710e7ef46baf1ef3d08f40809c011798ba6c0fd3e
8ac3f631818a77771d58d2df716fa1c3549dc6203ff5a7856a1c6c9a99c6f78d5d0120139399fa6dcb4838a8c5ceb63c05902d243fa0043580aa2841e51cba402131a556b70a766d0a9a0827c3707548076cb0f3bf373b2e807816
ddfcdc764261fc43cb65c43f5fe8ceb5a0f83d140248628dda298b9212d14271a35f45c26c34baaa1211eec8dc86bb47b44fbe8a3d71c9357c194b9f72197ef2037087ed0513bae49224bf2cc1cac81b889e93bc572f6fcce09d0a
6f0c9a54e782b6d51faccca2c2485574ad5b54cbc010d0941bd92fae66da2cdc493de376964a1dcad7ddbc4e1dbaafc54cf5d428261813b5a8ba40f83b28b9d887f49ec4600c446d393117a20f8bfd1d71d1844bca3bcb18ebb009
faf00e5111f9920552430d5aff132dfd4107add2bae28dc378d38fe702852c0385a0460a2916c208e917ddc94f72ed7ff3d20ac40b9c182a24d5cf8dc67254bbb4b236d8e521a4ba2c5b838e2735db4586564dad414f881a3e064
c322cd717dfbac10d609797c77992226c273ac185a78ed66bfbe60b9573c5a887bb5cf2ebc59693478c67db25d2675c99e942c7cc644f39d7eac2cb52473340bb3e00fe82f140a9038c9f5f1b0433f2c1f9f486e95c306e26e581a
41bc95b80a78ae5eb0d595af9ced3f24da4caa61dd7d6e4f84e54636b40b3fbda1e79af18c4c26156cb744f95cc3b6324a592ca07627e1cb2ee6b36eb3a3aef054484b09f60703a18dc34fca4e2b5d5cce5025499eac32e471fd54
7447d7809df2d7d24b6165e799a075ab5d091a02be71611fc9d796834560c761070f06429856d96854fdeb1d34d164e3788f53bba252fa80e51e3f7b66dfb0c8e149e31afe8979f6bca1d189e626057df1904b4ebf01a1366aa1f2
74a0001000001383977&srngstate:1103013865XZA112210f4b16c1cb10507a1f38cb440c40003c9a83566fa1201b69ab0aff2f2401e18&data:&dsum:0&loopt:&srngcheck:0
l:5&rng:XAA0000000000030390807dc721521c1068239508a962ee8101169323a15d9b92d24b570a7fd53dfedb2ecbd28d4c5efae220a2d5327cd7542b63fe65bc3b35aa11c82752a855ccbaf0a3775dffb369eccffab9dca3e
aea9606a0e7af034bfc5ad38612b5da740ea5dd0c55f0f169a7c954c779e00aed430fe68ac2dda135f56664c30f69441b4d9a12c68a816903f78422debb508304398f3fcb9861d4870f25726187487bef644ec2d7622e0ead731a
4f1207bab25f73ecbf50318d57f0ed16550965068b333a17f50ed63d652a4470fabd85042901e0a18ca34ec9ccd630f1298d5cbba41d657acfc3d25a41e90a6ea18dad2c7ff9b710e7ef46baf1ef3d08f40809c011798ba6c0fd3e
8ac3f631818a77771d58d2df716fa1c3549dc6203ff5a7856a1c6c9a99c6f78d5d0120139399fa6dcb4838a8c5ceb63c05902d243fa0043580aa2841e51cba402131a556b70a766d0a9a0827c3707548076cb0f3bf373b2e807816
ddfcdc764261fc43cb65c43f5fe8ceb5a0f83d140248628dda298b9212d14271a35f45c26c34baaa1211eec8dc86bb47b44fbe8a3d71c9357c194b9f72197ef2037087ed0513bae49224bf2cc1cac81b889e93bc572f6fcce09d0a
6f0c9a54e782b6d51faccca2c2485574ad5b54cbc010d0941bd92fae66da2cdc493de376964a1dcad7ddbc4e1dbaafc54cf5d428261813b5a8ba40f83b28b9d887f49ec4600c446d393117a20f8bfd1d71d1844bca3bcb18ebb009
faf00e5111f9920552430d5aff132dfd4107add2bae28dc378d38fe702852c0385a0460a2916c208e917ddc94f72ed7ff3d20ac40b9c182a24d5cf8dc67254bbb4b236d8e521a4ba2c5b838e2735db4586564dad414f881a3e064
c322cd717dfbac10d609797c77992226c273ac185a78ed66bfbe60b9573c5a887bb5cf2ebc59693478c67db25d2675c99e942c7cc644f39d7eac2cb52473340bb3e00fe82f140a9038c9f5f1b0433f2c1f9f486e95c306e26e581a
41bc95b80a78ae5eb0d595af9ced3f24da4caa61dd7d6e4f84e54636b40b3fbda1e79af18c4c26156cb744f95cc3b6324a592ca07627e1cb2ee6b36eb3a3aef054484b09f60703a18dc34fca4e2b5d5cce5025499eac32e471fd54
7447d7809df2d7d24b6165e799a075ab5d091a02be71611fc9d796834560c761070f06429856d96854fdeb1d34d164e3788f53bba252fa80e51e3f7b66dfb0c8e149e31afe8979f6bca1d189e626057df1904b4ebf01a1366aa1f2
74a0001000001383977&srngstate:1103013865XZA112210f4b16c1cb10507a1f38cb440c40003c9a83566fa1201b69ab0aff2f2401e18&data:&dsum:1543242008&loopt:&srngcheck:1543242008
```

Handles loops and sub-do-files

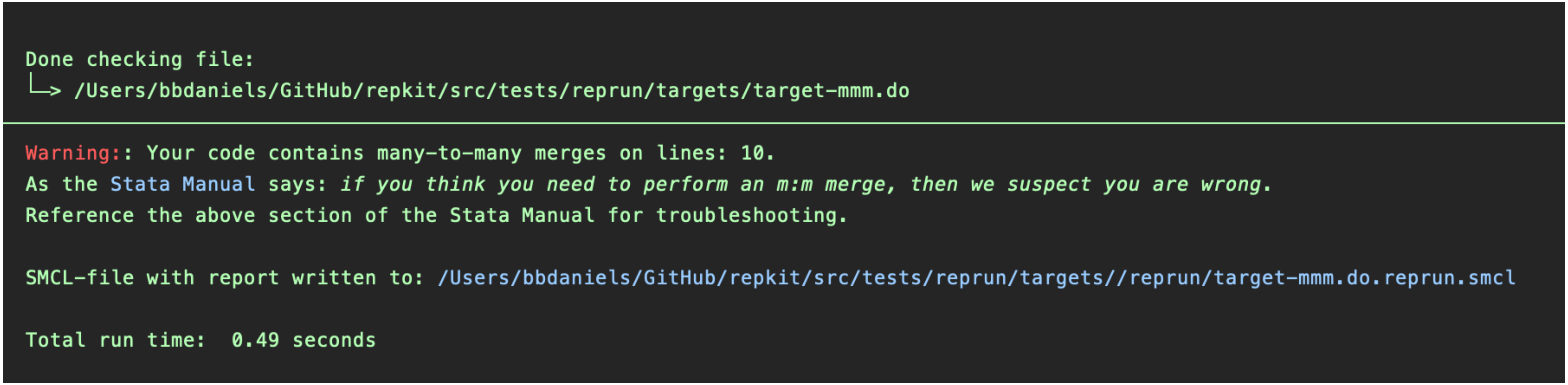


```
Generating the report for comparing the two runs.

reprun output created by user bbdaniels at 19 Jul 2024 16:15:56
Operating System Mac (Apple Silicon) MacOSX 14.5.0
Stata MP - Version 18.5 running as version 14.1

Checking file:
└─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-2.do

Lines where Run 1 and Run 2 mismatch for any value:

               Seed RNG State              Sort Order RNG             Data Checksum
Line #   Run 1    Run 2    Match    Run 1    Run 2    Match    Run 1    Run 2    Match    Loop iteration:

15                                  Change   Change   DIFF     Change   Change   DIFF
22       Change   Change   OK!                                 Change   Change   DIFF     x:1 type:A
22       Change   Change   OK!                                 Change   Change   DIFF     x:1 type:B
22       Change   Change   OK!                                 Change   Change   DIFF     x:1 type:C
22       Change   Change   OK!                                 Change   Change   DIFF     x:2 type:A
22       Change   Change   OK!                                 Change   Change   DIFF     x:2 type:B
22       Change   Change   OK!                                 Change   Change   DIFF     x:2 type:C
22       Change   Change   OK!                                 Change   Change   DIFF     x:3 type:A
22       Change   Change   OK!                                 Change   Change   DIFF     x:3 type:B
22       Change   Change   OK!                                 Change   Change   DIFF     x:3 type:C
22       Change   Change   OK!                                 Change   Change   DIFF     x:4 type:A
22       Change   Change   OK!                                 Change   Change   DIFF     x:4 type:B
22       Change   Change   OK!                                 Change   Change   DIFF     x:4 type:C
22       Change   Change   OK!                                 Change   Change   DIFF     x:5 type:A
22       Change   Change   OK!                                 Change   Change   DIFF     x:5 type:B
22       Change   Change   OK!                                 Change   Change   DIFF     x:5 type:C
26                                                             Change   Change   DIFF
27       Change   Change   OK!                                 Change   Change   DIFF
31                                  Change   Change   DIFF     Change   Change   DIFF
```



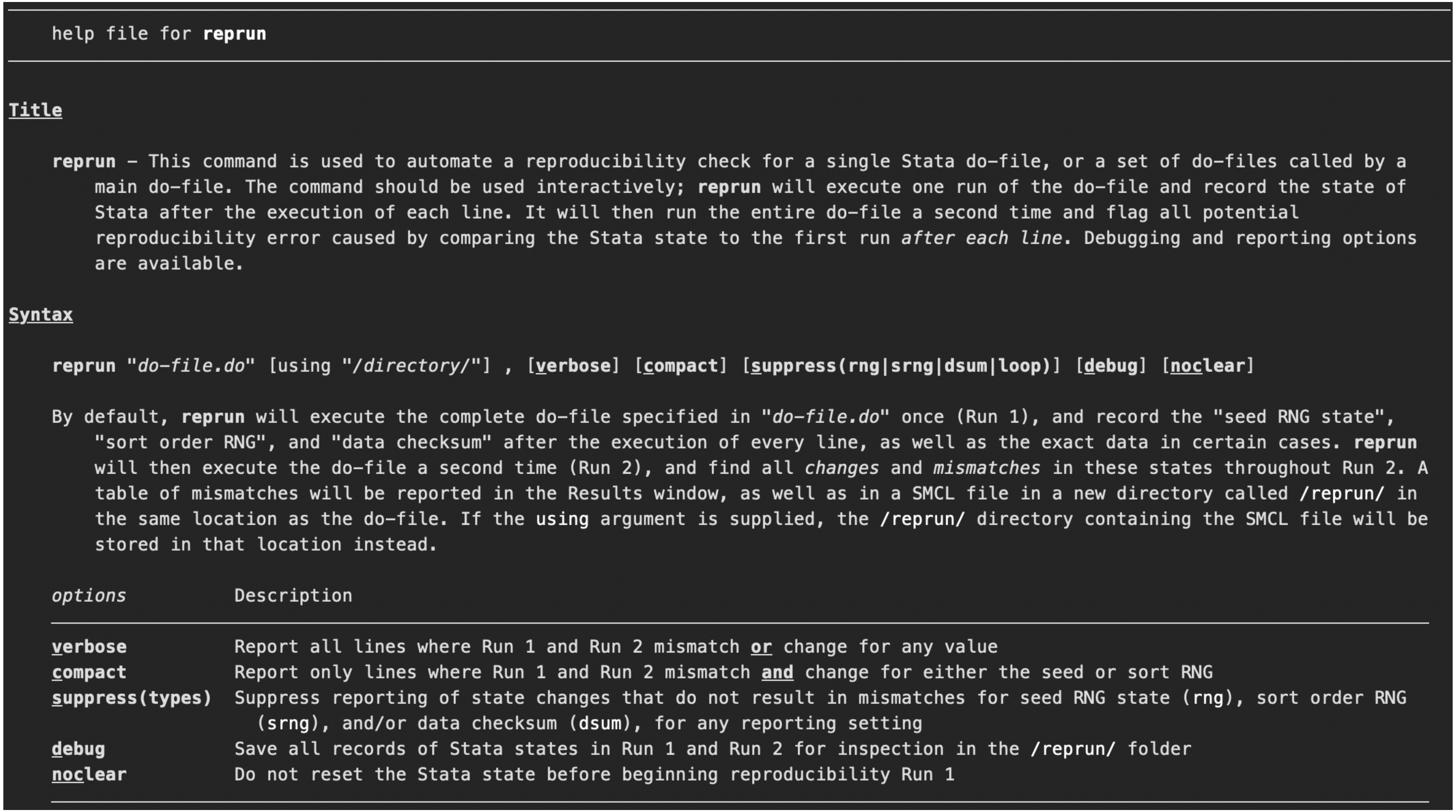
```
Stepping into sub-file:
└─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-2.do
└──> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-3.do

Lines where Run 1 and Run 2 mismatch for any value:

               Seed RNG State              Sort Order RNG             Data Checksum
Line #   Run 1    Run 2    Match    Run 1    Run 2    Match    Run 1    Run 2    Match    Loop iteration:

15                                  Change   Change   DIFF     Change   Change   DIFF
19                                                             Change   Change   DIFF
20       Change   Change   OK!                                 Change   Change   DIFF
24                                  Change   Change   DIFF     Change   Change   DIFF

Stepping back into file:
└─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-2.do

Lines where Run 1 and Run 2 mismatch for any value:

               Seed RNG State              Sort Order RNG             Data Checksum
Line #   Run 1    Run 2    Match    Run 1    Run 2    Match    Run 1    Run 2    Match    Loop iteration:

33                                  Change   Change   DIFF     Change   Change   DIFF

Done checking file:
└─> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-2.do

SMCL-file with report written to: /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/output-2/reprun/t

Total run time:  0.35 seconds
```

It will only yell at you if you do the forbidden merge



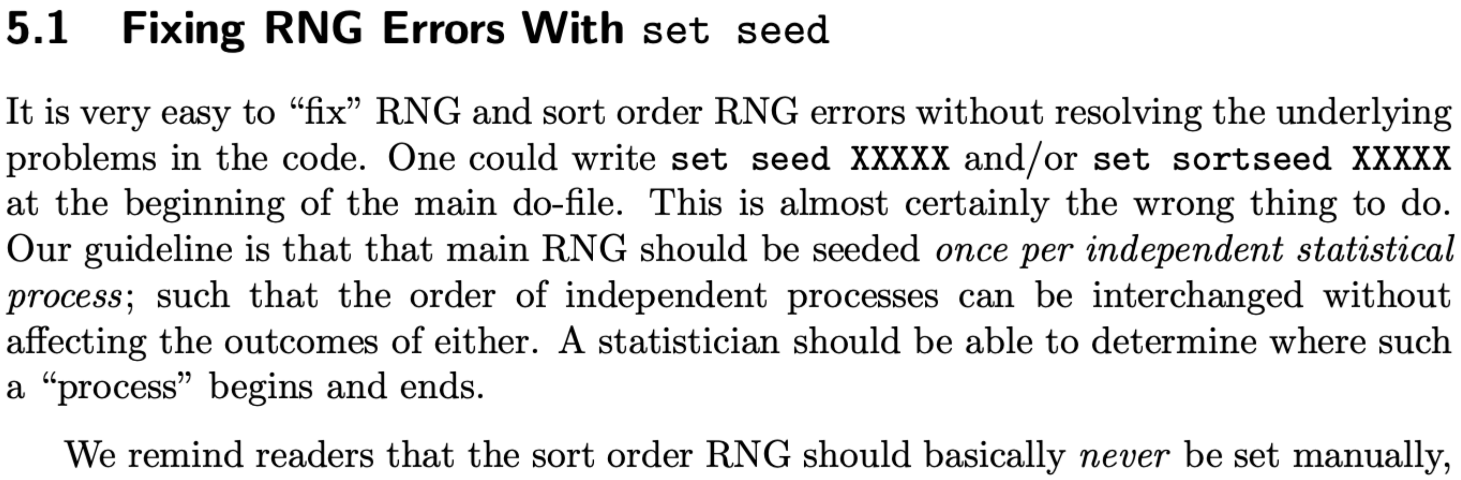
```
Done checking file:
 └> /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets/target-mmm.do

Warning:: Your code contains many-to-many merges on lines: 10.
As the Stata Manual says: if you think you need to perform an m:m merge, then we suspect you are wrong.
Reference the above section of the Stata Manual for troubleshooting.

SMCL-file with report written to: /Users/bbdaniels/GitHub/repkit/src/tests/reprun/targets//reprun/target-mmm.do.reprun.smcl

Total run time:  0.49 seconds
```

Current syntax



```
    help file for reprun
-------------------------------------------------------------------------------------------------------------------------

Title

    reprun - This command is used to automate a reproducibility check for a single Stata do-file, or a set of do-files called by a
        main do-file. The command should be used interactively; reprun will execute one run of the do-file and record the state of
        Stata after the execution of each line. It will then run the entire do-file a second time and flag all potential
        reproducibility error caused by comparing the Stata state to the first run after each line. Debugging and reporting options
        are available.

Syntax

    reprun "do-file.do" [using "/directory/"] , [verbose] [compact] [suppress(rng|srng|dsum|loop)] [debug] [noclear]

    By default, reprun will execute the complete do-file specified in "do-file.do" once (Run 1), and record the "seed RNG state",
        "sort order RNG", and "data checksum" after the execution of every line, as well as the exact data in certain cases. reprun
        will then execute the do-file a second time (Run 2), and find all changes and mismatches in these states throughout Run 2. A
        table of mismatches will be reported in the Results window, as well as in a SMCL file in a new directory called /reprun/ in
        the same location as the do-file. If the using argument is supplied, the /reprun/ directory containing the SMCL file will be
        stored in that location instead.

    options           Description
    -----------------------------------------------------------------------------------------------------------------------
    verbose           Report all lines where Run 1 and Run 2 mismatch or change for any value
    compact           Report only lines where Run 1 and Run 2 mismatch and change for either the seed or sort RNG
    suppress(types)   Suppress reporting of state changes that do not result in mismatches for seed RNG state (rng), sort order RNG
                        (srng), and/or data checksum (dsum), for any reporting setting
    debug             Save all records of Stata states in Run 1 and Run 2 for inspection in the /reprun/ folder
    noclear           Do not reset the Stata state before beginning reproducibility Run 1
    -----------------------------------------------------------------------------------------------------------------------
```

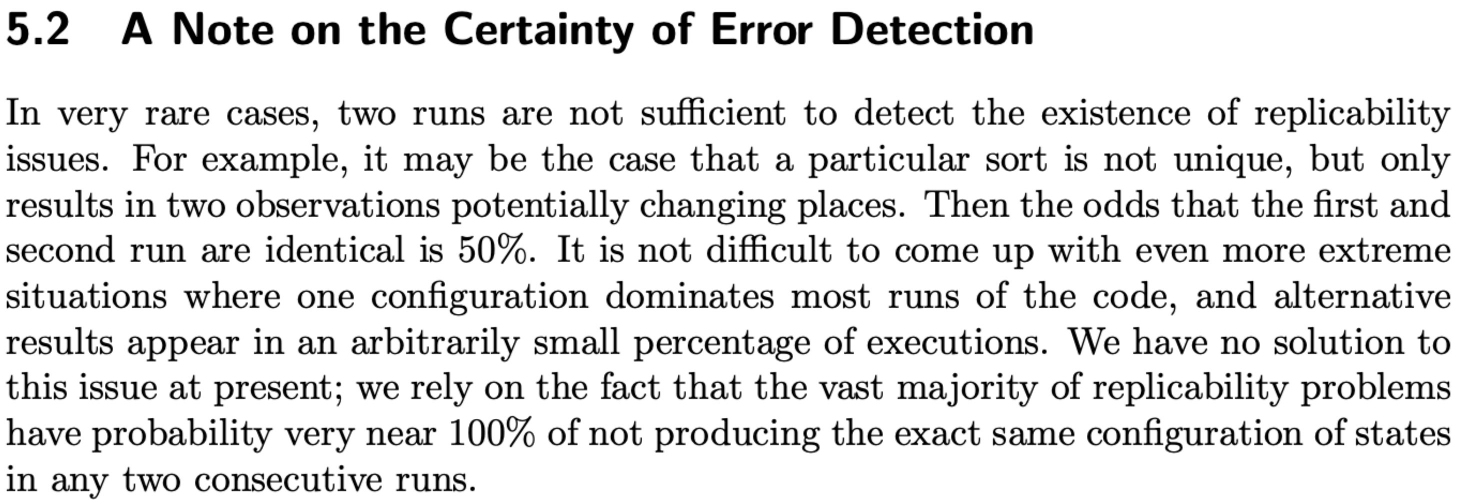
Two things to note:



5.1 Fixing RNG Errors With `set seed`

It is very easy to "fix" RNG and sort order RNG errors without resolving the underlying problems in the code. One could write **`set seed XXXXX`** and/or **`set sortseed XXXXX`** at the beginning of the main do-file. This is almost certainly the wrong thing to do. Our guideline is that that main RNG should be seeded *once per independent statistical process*; such that the order of independent processes can be interchanged without affecting the outcomes of either. A statistician should be able to determine where such a "process" begins and ends.

We remind readers that the sort order RNG should basically *never* be set manually,



5.2 A Note on the Certainty of Error Detection

In very rare cases, two runs are not sufficient to detect the existence of replicability issues. For example, it may be the case that a particular sort is not unique, but only results in two observations potentially changing places. Then the odds that the first and second run are identical is 50%. It is not difficult to come up with even more extreme situations where one configuration dominates most runs of the code, and alternative results appear in an arbitrarily small percentage of executions. We have no solution to this issue at present; we rely on the fact that the vast majority of replicability problems have probability very near 100% of not producing the exact same configuration of states in any two consecutive runs.

In practice

Reproducibility Verification in Practice

Reviewer confirms the package is:

Complete

Produces every output in the manuscript

Stable

Produces the same outputs every run

Consistent

Tables and figures reproduced match exactly those in the paper

reprun helps confirm stability

Complete

Produces every output in the manuscript

Stable

Produces the same outputs every run

Consistent

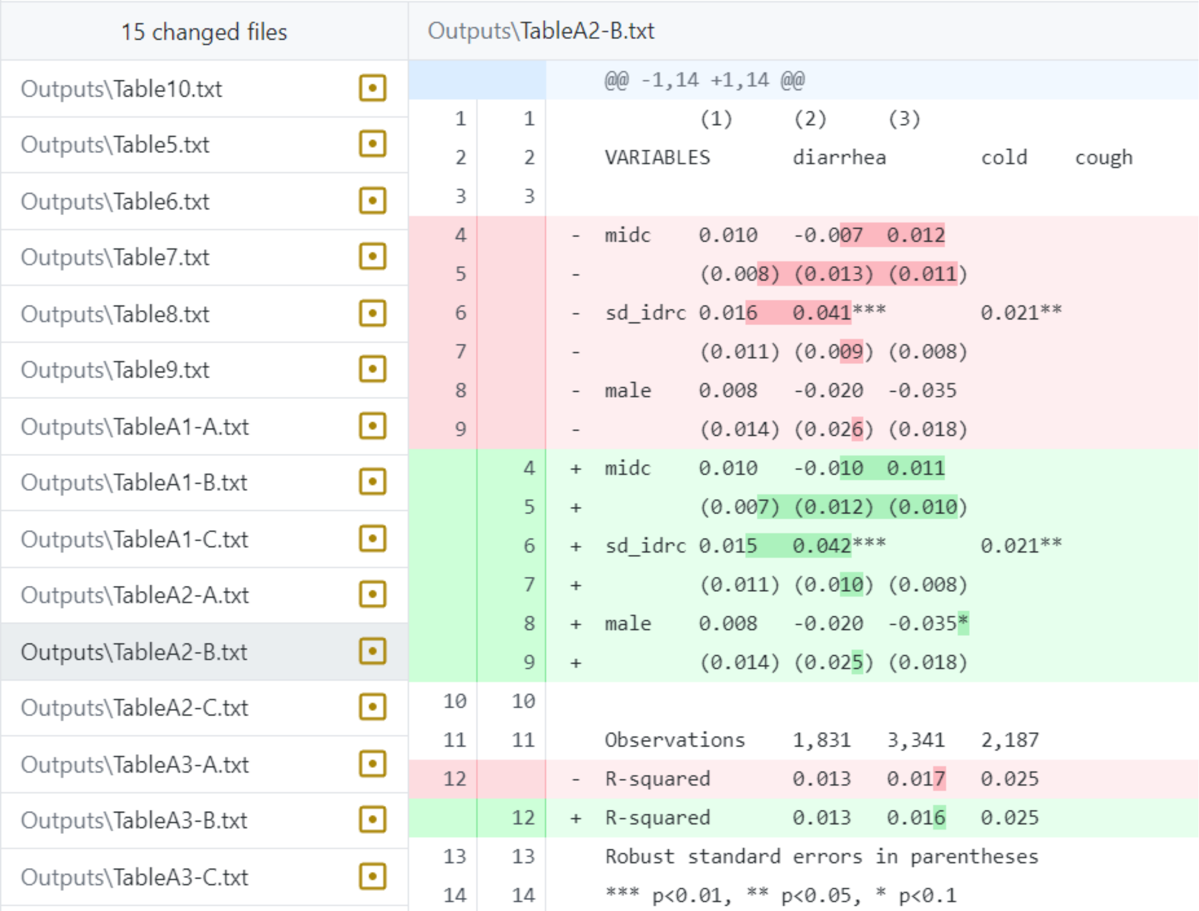
Tables and figures reproduced match exactly those in the paper

Example 1

Unstable sorting

Identifying instability in outputs

- Received a package for reproducibility verification.
- Observed slight instability in nearly all results every time the code was executed.
- Instability was detectable only by tracking changes in Git.



15 changed files

Outputs\Table10.txt
Outputs\Table5.txt
Outputs\Table6.txt
Outputs\Table7.txt
Outputs\Table8.txt
Outputs\Table9.txt
Outputs\TableA1-A.txt
Outputs\TableA1-B.txt
Outputs\TableA1-C.txt
Outputs\TableA2-A.txt
Outputs\TableA2-B.txt
Outputs\TableA2-C.txt
Outputs\TableA3-A.txt
Outputs\TableA3-B.txt
Outputs\TableA3-C.txt

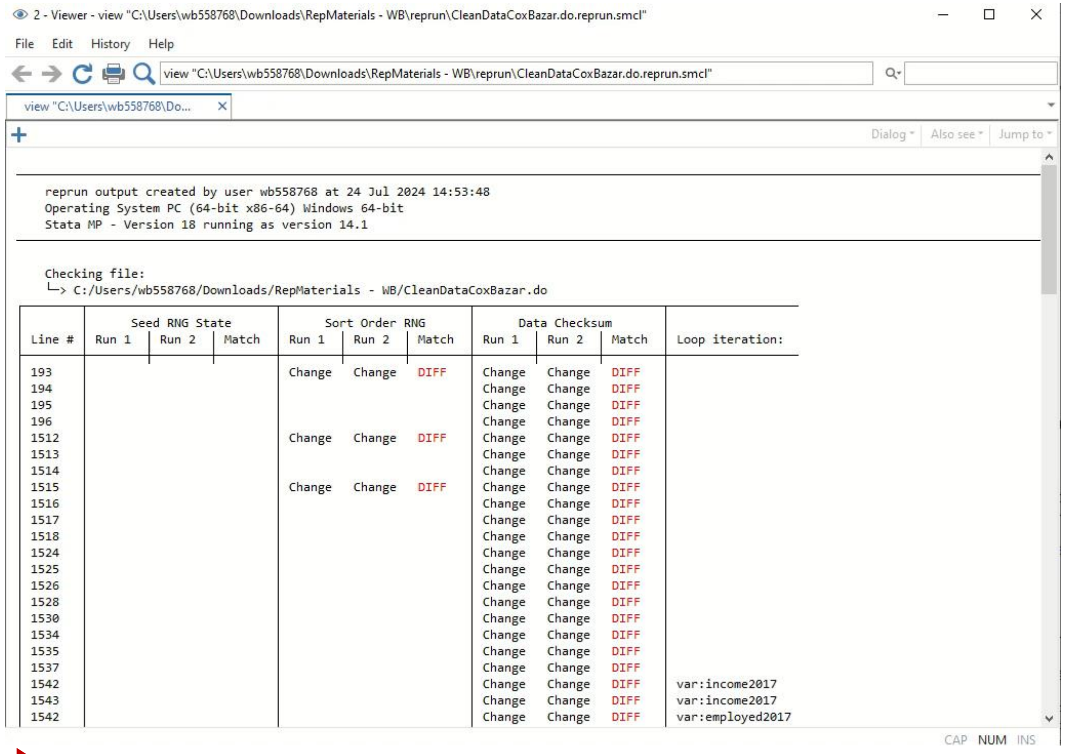
Outputs\TableA2-B.txt

```
  @@ -1,14 +1,14 @@
          (1)     (2)     (3)
  VARIABLES       diarrhea        cold    cough

- midc    0.010   -0.007  0.012
-         (0.008) (0.013) (0.011)
- sd_idrc 0.016   0.041***        0.021**
-         (0.011) (0.009) (0.008)
- male    0.008   -0.020  -0.035
-         (0.014) (0.026) (0.018)
+ midc    0.010   -0.010  0.011
+         (0.007) (0.012) (0.010)
+ sd_idrc 0.015   0.042***        0.021**
+         (0.011) (0.010) (0.008)
+ male    0.008   -0.020  -0.035*
+         (0.014) (0.025) (0.018)

  Observations    1,831   3,341   2,187
- R-squared       0.013   0.017   0.025
+ R-squared       0.013   0.016   0.025
  Robust standard errors in parentheses
  *** p<0.01, ** p<0.05, * p<0.1
```

Identifying source using **`reprun`**

Running `reprun` on the do-file

- Flags changes in sort RNG order and Data Checksum
- Default option generates a long report →


2 - Viewer - view "C:\Users\wb558768\Downloads\RepMaterials - WB\reprun\CleanDataCoxBazar.do.reprun.smcl"
File
Edit
History
Help
view "C:\Users\wb558768\Downloads\RepMaterials - WB\reprun\CleanDataCoxBazar.do.reprun.smcl"
view "C:\Users\wb558768\Do...
Dialog
Also see
Jump to
CAP
NUM
INS

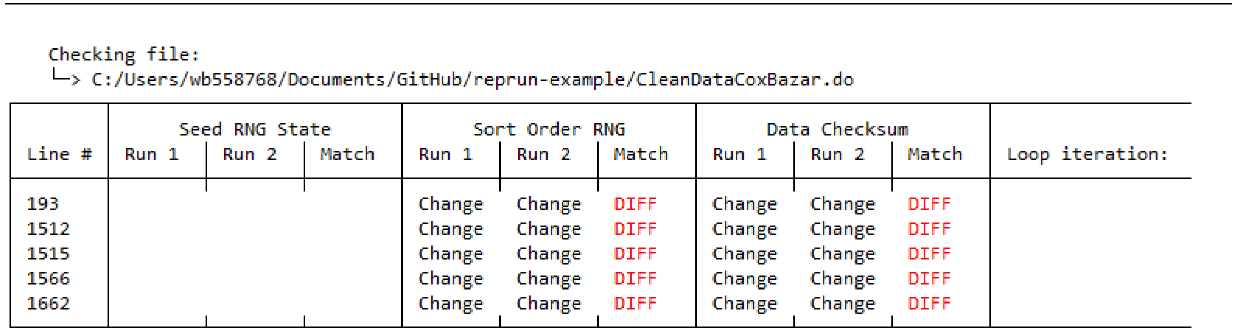
```
  reprun output created by user wb558768 at 24 Jul 2024 14:53:48
  Operating System PC (64-bit x86-64) Windows 64-bit
  Stata MP - Version 18 running as version 14.1


  Checking file:
  └> C:/Users/wb558768/Downloads/RepMaterials - WB/CleanDataCoxBazar.do

|        |    Seed RNG State    |    Sort Order RNG    |    Data Checksum     |
| Line # | Run 1 | Run 2 | Match| Run 1 | Run 2 | Match| Run 1 | Run 2 | Match| Loop iteration:

  193                            Change  Change  DIFF   Change  Change  DIFF
  194                                                   Change  Change  DIFF
  195                                                   Change  Change  DIFF
  196                                                   Change  Change  DIFF
  1512                           Change  Change  DIFF   Change  Change  DIFF
  1513                                                  Change  Change  DIFF
  1514                                                  Change  Change  DIFF
  1515                           Change  Change  DIFF   Change  Change  DIFF
  1516                                                  Change  Change  DIFF
  1517                                                  Change  Change  DIFF
  1518                                                  Change  Change  DIFF
  1524                                                  Change  Change  DIFF
  1525                                                  Change  Change  DIFF
  1526                                                  Change  Change  DIFF
  1528                                                  Change  Change  DIFF
  1530                                                  Change  Change  DIFF
  1534                                                  Change  Change  DIFF
  1535                                                  Change  Change  DIFF
  1537                                                  Change  Change  DIFF
  1542                                                  Change  Change  DIFF   var:income2017
  1543                                                  Change  Change  DIFF   var:income2017
  1542                                                  Change  Change  DIFF   var:employed2017
```

▶

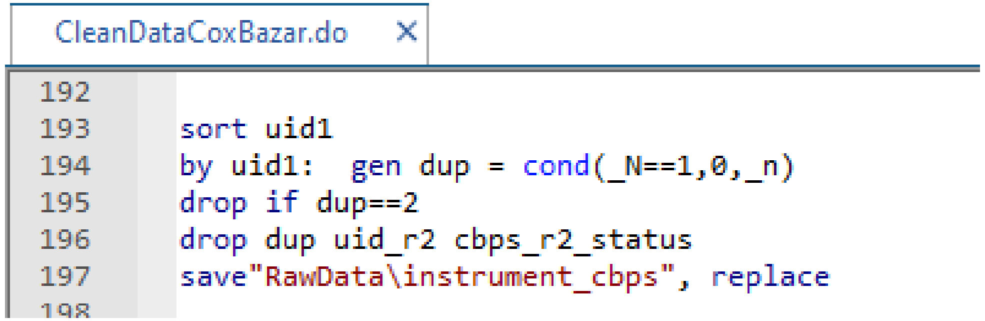
Compact reporting

Using compact option to quickly identify errors:

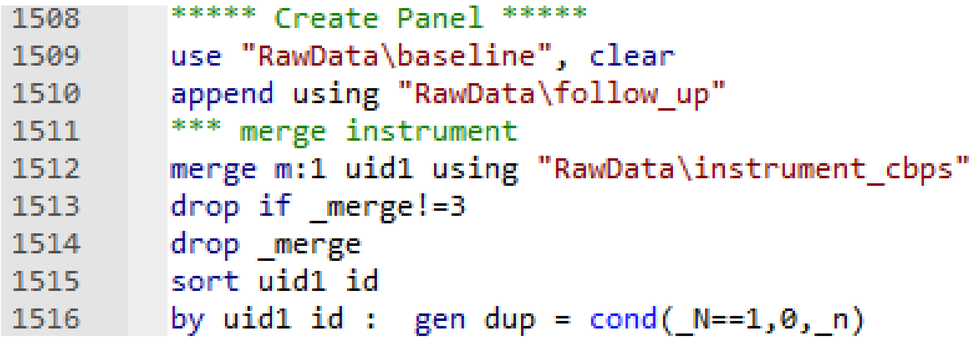
- Reports only lines where Run 1 and Run 2 mismatch **and** change for either the seed or sort RNG



```
  Checking file:
  └─> C:/Users/wb558768/Documents/GitHub/reprun-example/CleanDataCoxBazar.do

┌───────────┬─────────────────────────────┬─────────────────────────────┬─────────────────────────────┬────────────────────
│           │       Seed RNG State        │       Sort Order RNG        │        Data Checksum        │
│  Line #   │  Run 1  │  Run 2  │  Match  │  Run 1  │  Run 2  │  Match  │  Run 1  │  Run 2  │  Match  │  Loop iteration:
├───────────┼─────────────────────────────┼─────────────────────────────┼─────────────────────────────┼────────────────────
│  193      │         │         │         │  Change │  Change │  DIFF   │  Change │  Change │  DIFF   │
│  1512     │         │         │         │  Change │  Change │  DIFF   │  Change │  Change │  DIFF   │
│  1515     │         │         │         │  Change │  Change │  DIFF   │  Change │  Change │  DIFF   │
│  1566     │         │         │         │  Change │  Change │  DIFF   │  Change │  Change │  DIFF   │
│  1662     │         │         │         │  Change │  Change │  DIFF   │  Change │  Change │  DIFF   │
└───────────┴─────────────────────────────┴─────────────────────────────┴─────────────────────────────┴────────────────────
```



```
192
193   sort uid1
194   by uid1:  gen dup = cond(_N==1,0,_n)
195   drop if dup==2
196   drop dup uid_r2 cbps_r2_status
197   save"RawData\instrument_cbps", replace
198
```

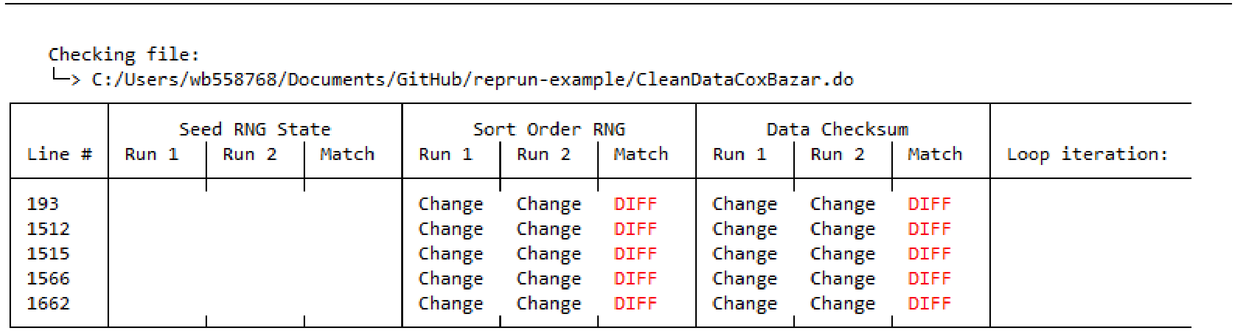


```
1508  ***** Create Panel *****
1509  use "RawData\baseline", clear
1510  append using "RawData\follow_up"
1511  *** merge instrument
1512  merge m:1 uid1 using "RawData\instrument_cbps"
1513  drop if _merge!=3
1514  drop _merge
1515  sort uid1 id
1516  by uid1 id :  gen dup = cond(_N==1,0,_n)
```

Compact reporting

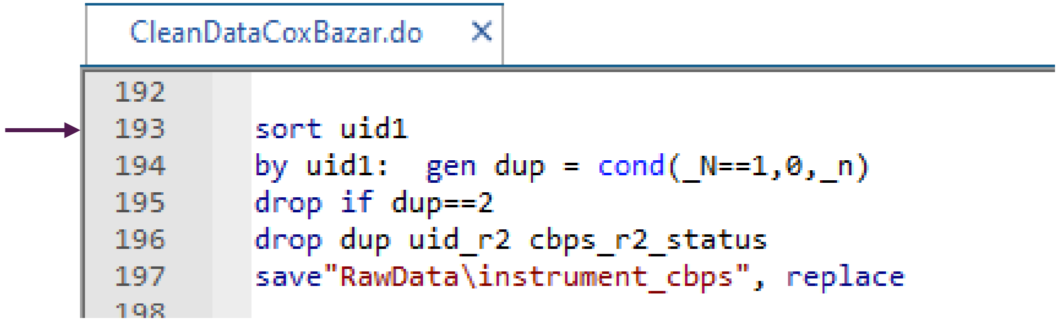
Using compact option to quickly identify errors:

- Reports only lines where Run 1 and Run 2 mismatch **and** change for either the seed or sort RNG



```
  Checking file:
  └─> C:/Users/wb558768/Documents/GitHub/reprun-example/CleanDataCoxBazar.do

|        |     Seed RNG State     |     Sort Order RNG     |     Data Checksum      |                 |
| Line # | Run 1  | Run 2  | Match | Run 1  | Run 2  | Match | Run 1  | Run 2  | Match | Loop iteration: |

| 193    |        |        |       | Change | Change | DIFF  | Change | Change | DIFF  |                 |
| 1512   |        |        |       | Change | Change | DIFF  | Change | Change | DIFF  |                 |
| 1515   |        |        |       | Change | Change | DIFF  | Change | Change | DIFF  |                 |
| 1566   |        |        |       | Change | Change | DIFF  | Change | Change | DIFF  |                 |
| 1662   |        |        |       | Change | Change | DIFF  | Change | Change | DIFF  |                 |
```

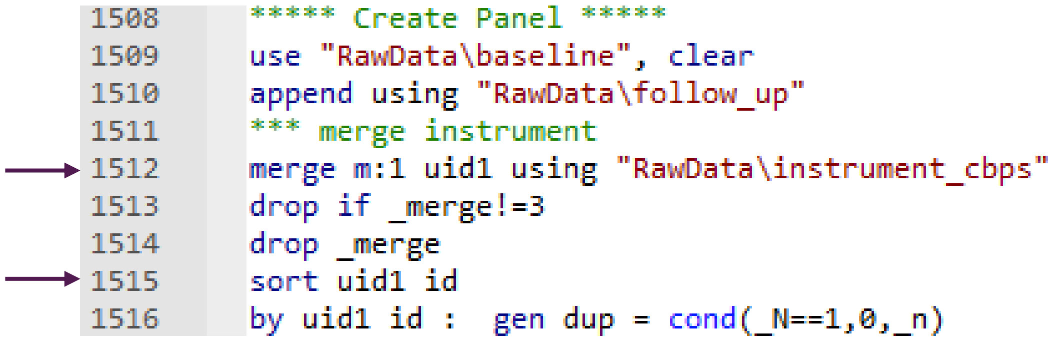
Line 193: Sorting on non-unique variable and dropping observations



CleanDataCoxBazar.do ✕

```
192
193   sort uid1
194   by uid1:   gen dup = cond(_N==1,0,_n)
195   drop if dup==2
196   drop dup uid_r2 cbps_r2_status
197   save"RawData\instrument_cbps", replace
198
```

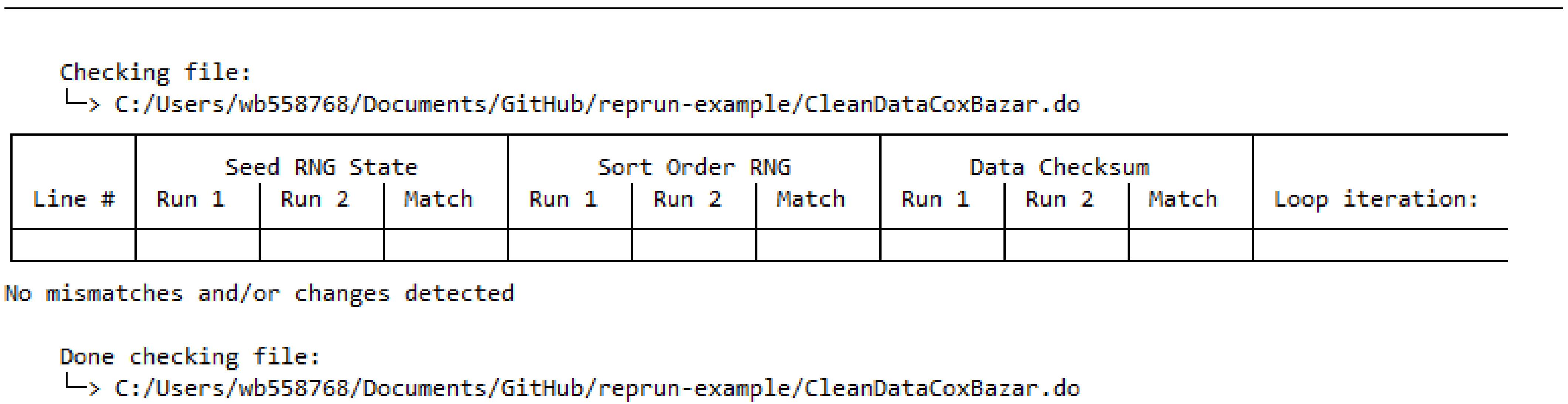
Line 1512: Merging resulting dataset
Line 1515: non-unique sort



```
1508   ***** Create Panel *****
1509   use "RawData\baseline", clear
1510   append using "RawData\follow_up"
1511   *** merge instrument
1512   merge m:1 uid1 using "RawData\instrument_cbps"
1513   drop if _merge!=3
1514   drop _merge
1515   sort uid1 id
1516   by uid1 id :  gen dup = cond(_N==1,0,_n)
```

Fixing the issues

Updated the code to sort uniquely, which resolved the original issue and the subsequent issues stemming from it.



```
  Checking file:
  └> C:/Users/wb558768/Documents/GitHub/reprun-example/CleanDataCoxBazar.do
┌────────┬──────────────────────────┬──────────────────────────┬──────────────────────────┬──────────────────
│        │      Seed RNG State      │      Sort Order RNG      │      Data Checksum       │
│ Line # │ Run 1  │ Run 2  │ Match  │ Run 1  │ Run 2  │ Match  │ Run 1  │ Run 2  │ Match  │ Loop iteration:
├────────┼────────┼────────┼────────┼────────┼────────┼────────┼────────┼────────┼────────┼──────────────────
│        │        │        │        │        │        │        │        │        │        │
└────────┴────────┴────────┴────────┴────────┴────────┴────────┴────────┴────────┴────────┴──────────────────
No mismatches and/or changes detected

  Done checking file:
  └> C:/Users/wb558768/Documents/GitHub/reprun-example/CleanDataCoxBazar.do
```

Example 2

m:m merge

Identifying instability in outputs

- Outputs were **not** compatible with Git for tracking changes.

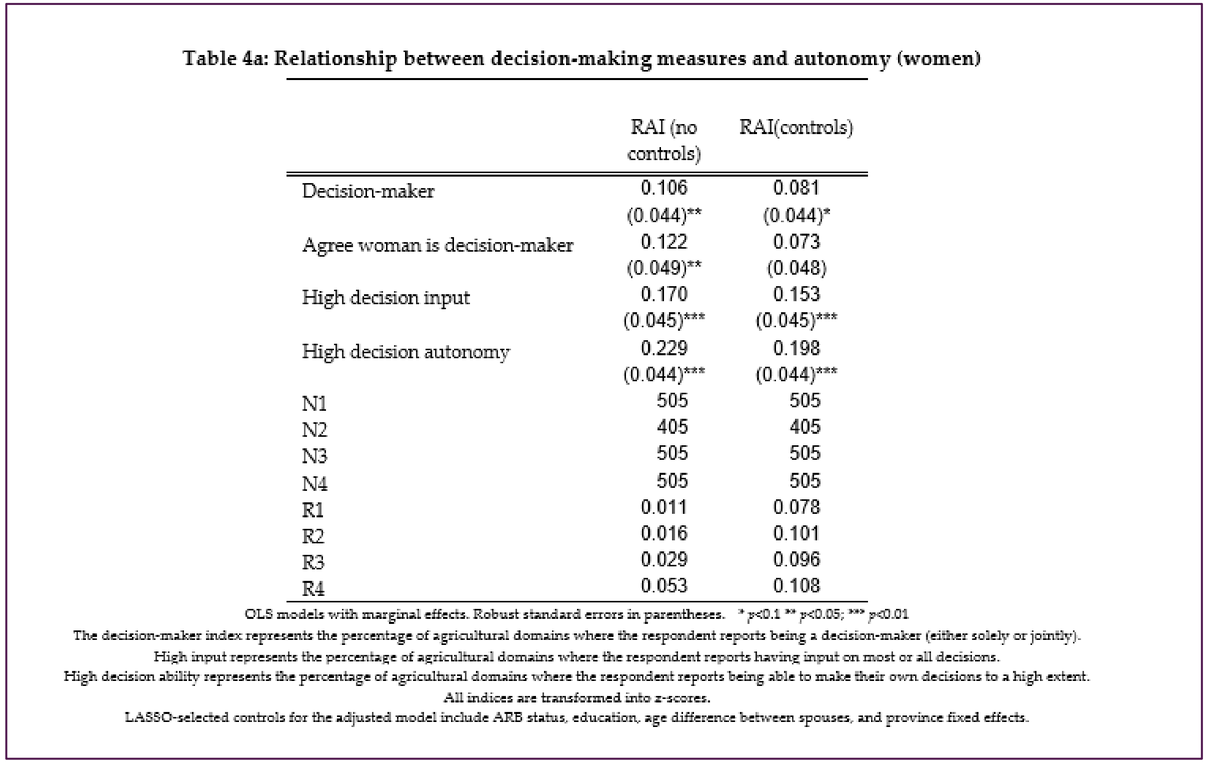


Table 4a: Relationship between decision-making measures and autonomy (women)

	RAI (no controls)	RAI(controls)
Decision-maker	0.106	0.081
	(0.044)**	(0.044)*
Agree woman is decision-maker	0.122	0.073
	(0.049)**	(0.048)
High decision input	0.170	0.153
	(0.045)***	(0.045)***
High decision autonomy	0.229	0.198
	(0.044)***	(0.044)***
N1	505	505
N2	405	405
N3	505	505
N4	505	505
R1	0.011	0.078
R2	0.016	0.101
R3	0.029	0.096
R4	0.053	0.108

OLS models with marginal effects. Robust standard errors in parentheses. * p<0.1 ** p<0.05; *** p<0.01
The decision-maker index represents the percentage of agricultural domains where the respondent reports being a decision-maker (either solely or jointly).
High input represents the percentage of agricultural domains where the respondent reports having input on most or all decisions.
High decision ability represents the percentage of agricultural domains where the respondent reports being able to make their own decisions to a high extent.
All indices are transformed into z-scores.
LASSO-selected controls for the adjusted model include ARB status, education, age difference between spouses, and province fixed effects.

Run 1

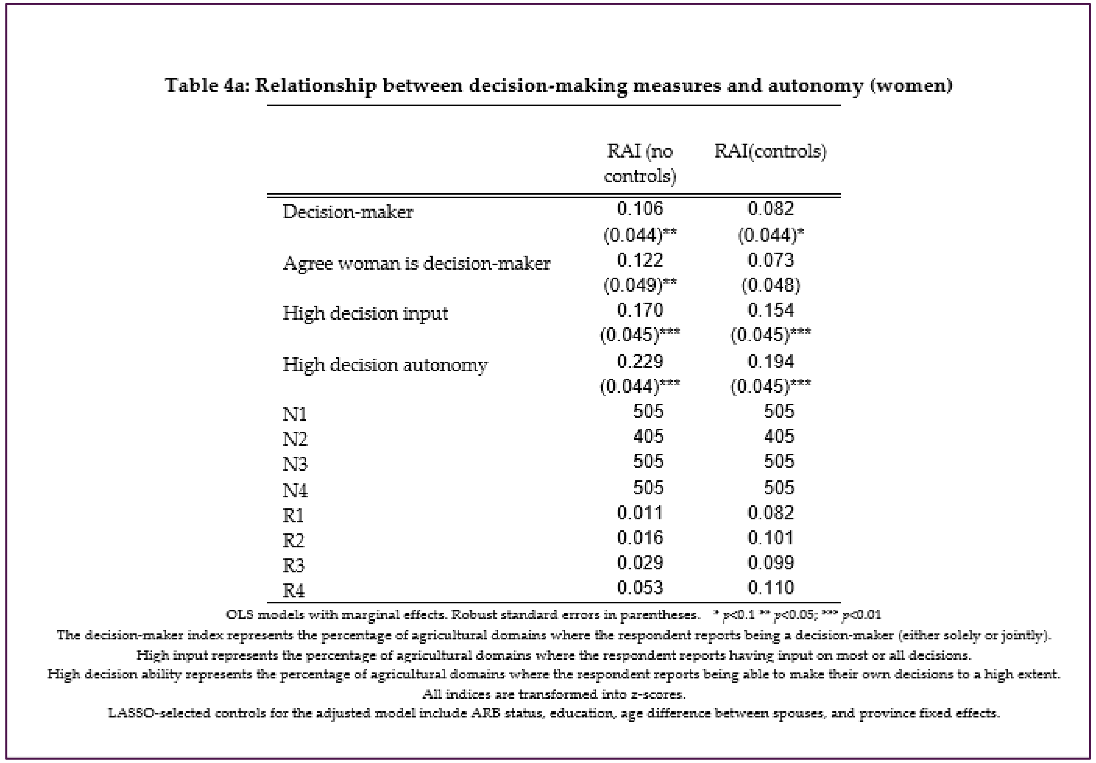


Table 4a: Relationship between decision-making measures and autonomy (women)

	RAI (no controls)	RAI(controls)
Decision-maker	0.106	0.082
	(0.044)**	(0.044)*
Agree woman is decision-maker	0.122	0.073
	(0.049)**	(0.048)
High decision input	0.170	0.154
	(0.045)***	(0.045)***
High decision autonomy	0.229	0.194
	(0.044)***	(0.045)***
N1	505	505
N2	405	405
N3	505	505
N4	505	505
R1	0.011	0.082
R2	0.016	0.101
R3	0.029	0.099
R4	0.053	0.110

OLS models with marginal effects. Robust standard errors in parentheses. * p<0.1 ** p<0.05; *** p<0.01
The decision-maker index represents the percentage of agricultural domains where the respondent reports being a decision-maker (either solely or jointly).
High input represents the percentage of agricultural domains where the respondent reports having input on most or all decisions.
High decision ability represents the percentage of agricultural domains where the respondent reports being able to make their own decisions to a high extent.
All indices are transformed into z-scores.
LASSO-selected controls for the adjusted model include ARB status, education, age difference between spouses, and province fixed effects.

Run 2

Identifying instability in outputs

- Outputs were **not** compatible with Git for tracking changes.
- Instability could only be identified through manual inspection.

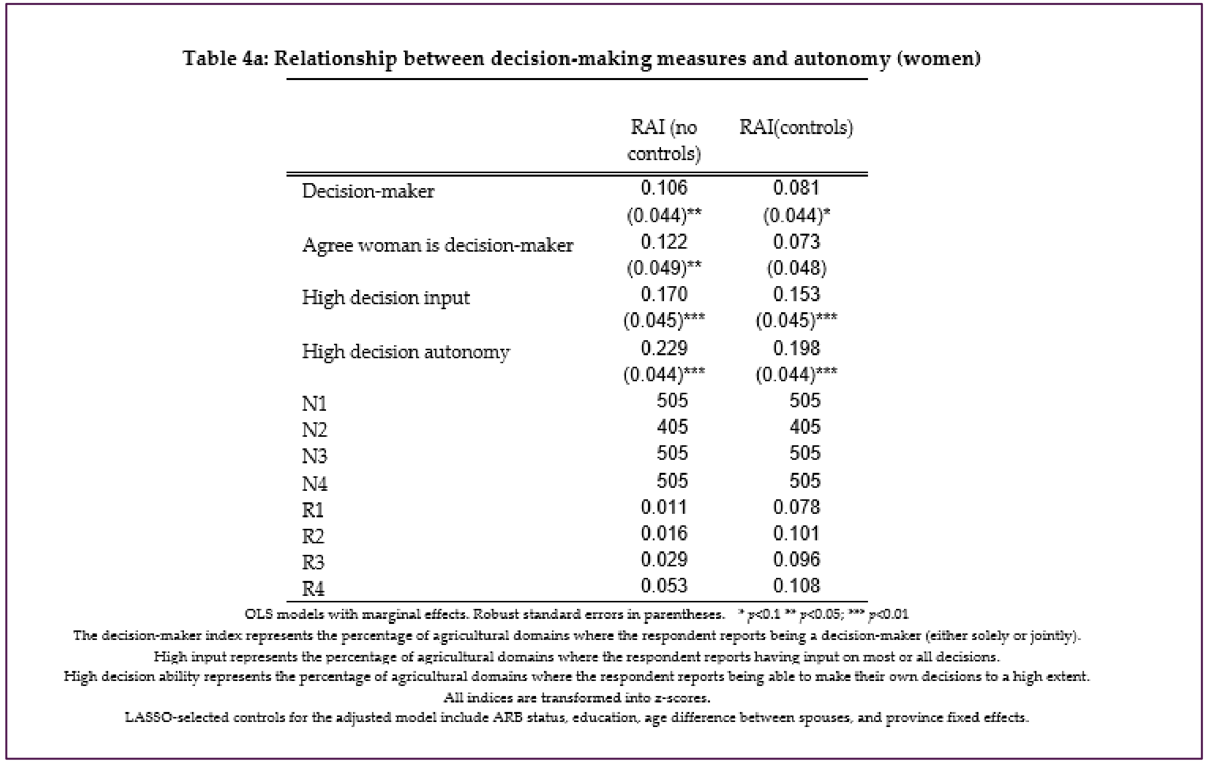


Table 4a: Relationship between decision-making measures and autonomy (women)

	RAI (no controls)	RAI(controls)
Decision-maker	0.106	0.081
	(0.044)**	(0.044)*
Agree woman is decision-maker	0.122	0.073
	(0.049)**	(0.048)
High decision input	0.170	0.153
	(0.045)***	(0.045)***
High decision autonomy	0.229	0.198
	(0.044)***	(0.044)***
N1	505	505
N2	405	405
N3	505	505
N4	505	505
R1	0.011	0.078
R2	0.016	0.101
R3	0.029	0.096
R4	0.053	0.108

OLS models with marginal effects. Robust standard errors in parentheses. * $p<0.1$ ** $p<0.05$; *** $p<0.01$
The decision-maker index represents the percentage of agricultural domains where the respondent reports being a decision-maker (either solely or jointly).
High input represents the percentage of agricultural domains where the respondent reports having input on most or all decisions.
High decision ability represents the percentage of agricultural domains where the respondent reports being able to make their own decisions to a high extent.
All indices are transformed into z-scores.
LASSO-selected controls for the adjusted model include ARB status, education, age difference between spouses, and province fixed effects.

Run 1

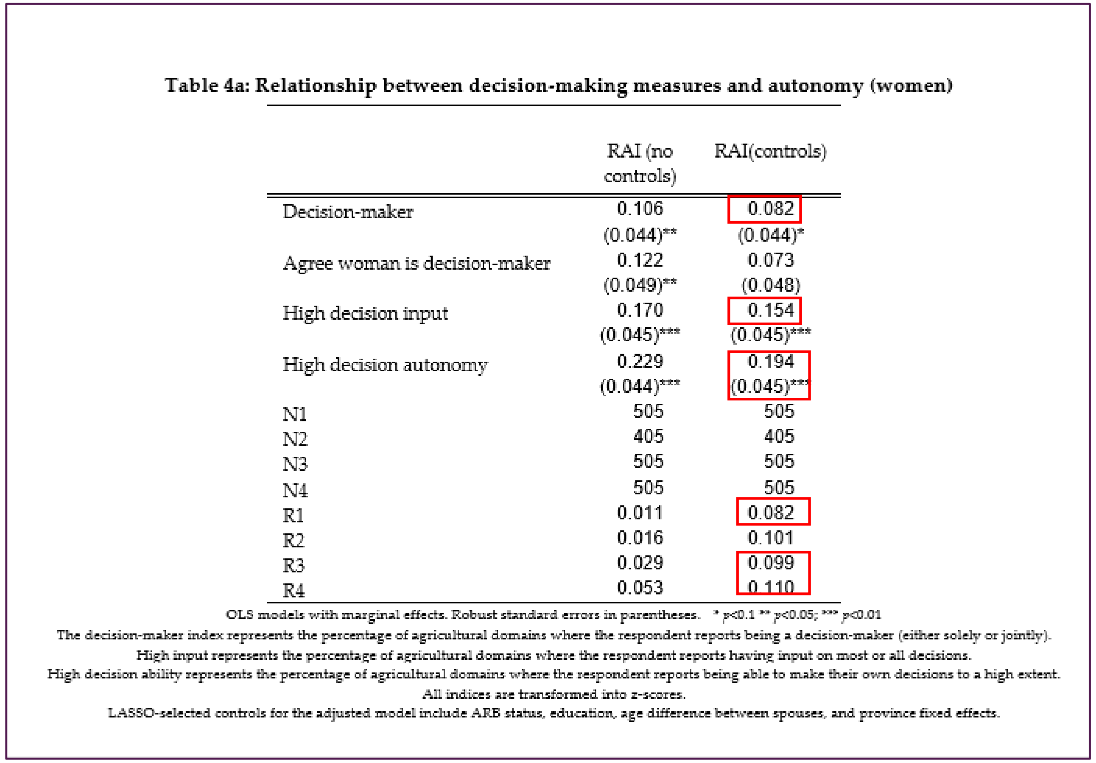


Table 4a: Relationship between decision-making measures and autonomy (women)

	RAI (no controls)	RAI(controls)
Decision-maker	0.106	0.082
	(0.044)**	(0.044)*
Agree woman is decision-maker	0.122	0.073
	(0.049)**	(0.048)
High decision input	0.170	0.154
	(0.045)***	(0.045)***
High decision autonomy	0.229	0.194
	(0.044)***	(0.045)***
N1	505	505
N2	405	405
N3	505	505
N4	505	505
R1	0.011	0.082
R2	0.016	0.101
R3	0.029	0.099
R4	0.053	0.110

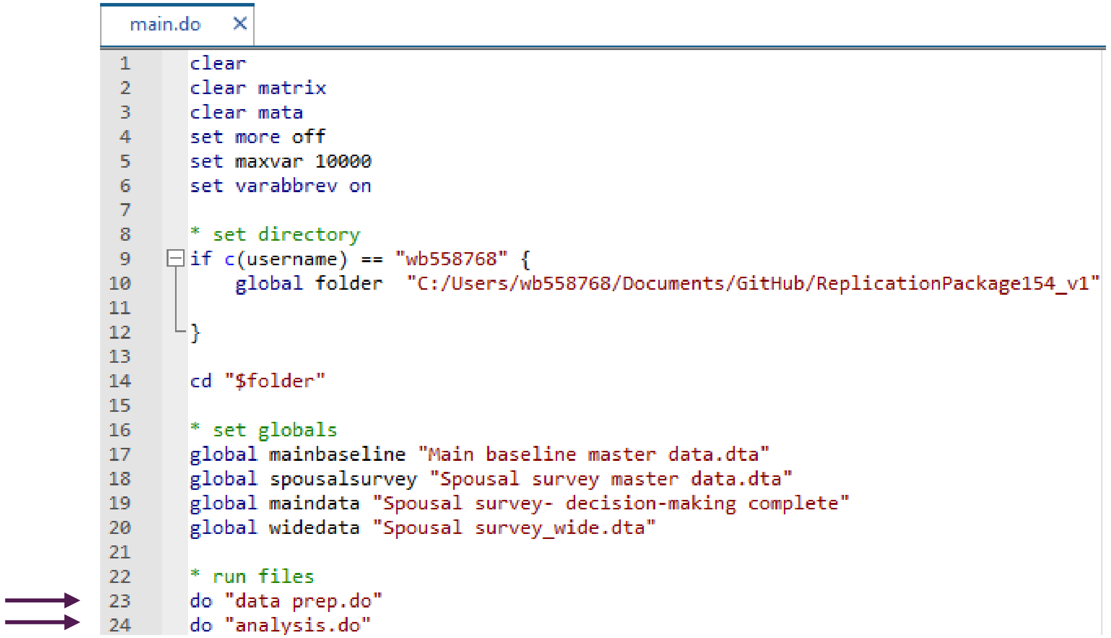
OLS models with marginal effects. Robust standard errors in parentheses. * $p<0.1$ ** $p<0.05$; *** $p<0.01$
The decision-maker index represents the percentage of agricultural domains where the respondent reports being a decision-maker (either solely or jointly).
High input represents the percentage of agricultural domains where the respondent reports having input on most or all decisions.
High decision ability represents the percentage of agricultural domains where the respondent reports being able to make their own decisions to a high extent.
All indices are transformed into z-scores.
LASSO-selected controls for the adjusted model include ARB status, education, age difference between spouses, and province fixed effects.

Run 2

Identifying source using `reprun`

- Setup: main do-file calling two other do-files
- Running `reprun`:

```
reprun “${folder}/main.do”, compact
```



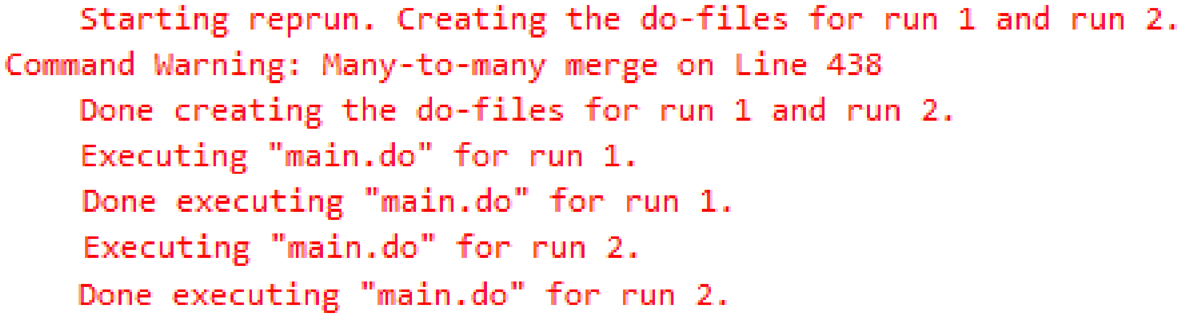
```
clear
clear matrix
clear mata
set more off
set maxvar 10000
set varabbrev on

* set directory
if c(username) == "wb558768" {
    global folder  "C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1"

}

cd "$folder"

* set globals
global mainbaseline "Main baseline master data.dta"
global spousalsurvey "Spousal survey master data.dta"
global maindata "Spousal survey- decision-making complete"
global widedata "Spousal survey_wide.dta"

* run files
do "data prep.do"
do "analysis.do"
```

Identifying source using reprun

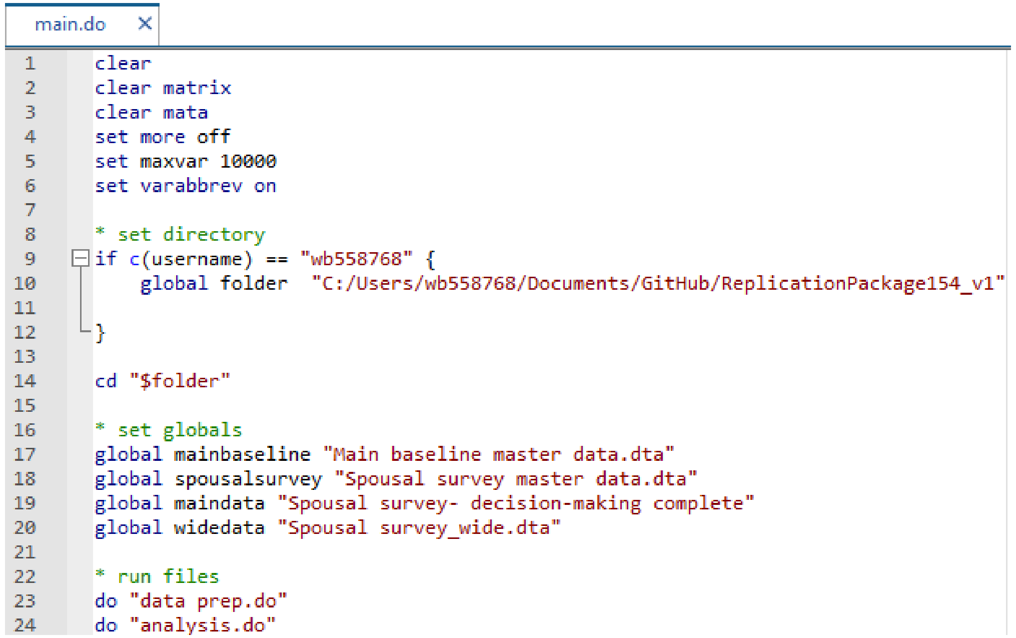
- Setup: main do-file calling two other do-files
- Running reprun:

```
reprun “${folder}/main.do”, compact
```

- Warning in the result window: many-to-many merge



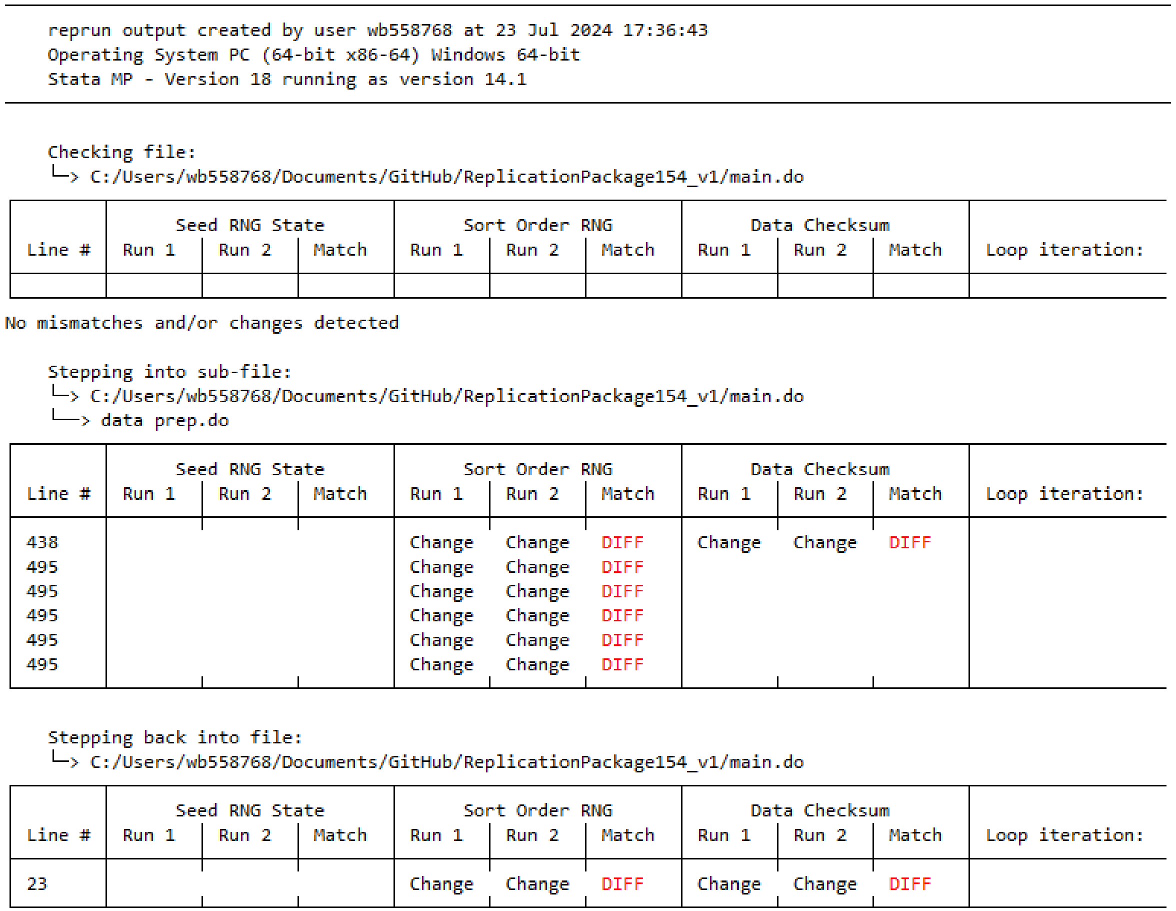
```
    Starting reprun. Creating the do-files for run 1 and run 2.
Command Warning: Many-to-many merge on Line 438
    Done creating the do-files for run 1 and run 2.
    Executing "main.do" for run 1.
    Done executing "main.do" for run 1.
    Executing "main.do" for run 2.
    Done executing "main.do" for run 2.
```



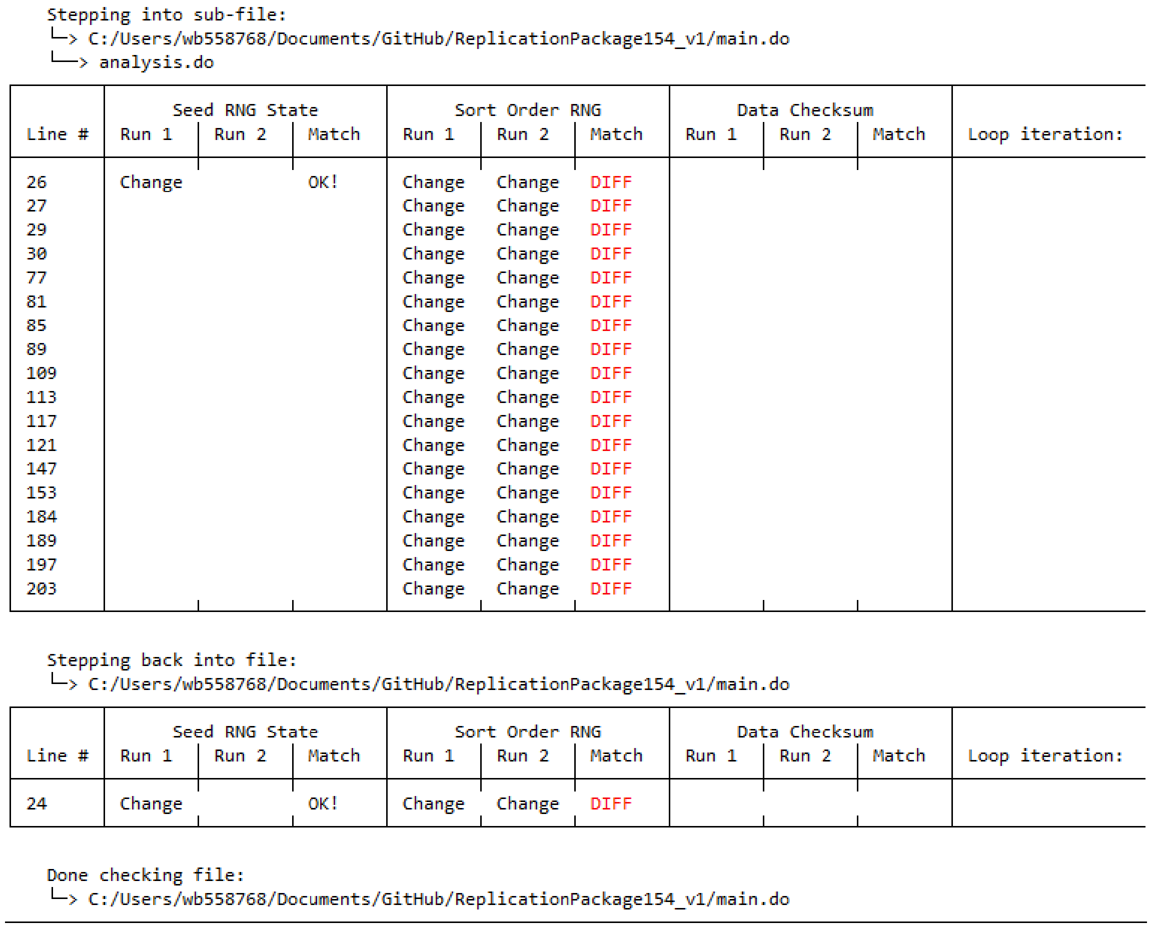
```
clear
clear matrix
clear mata
set more off
set maxvar 10000
set varabbrev on

* set directory
if c(username) == "wb558768" {
    global folder  "C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1"

}

cd "$folder"

* set globals
global mainbaseline "Main baseline master data.dta"
global spousalsurvey "Spousal survey master data.dta"
global maindata "Spousal survey- decision-making complete"
global widedata "Spousal survey_wide.dta"

* run files
do "data prep.do"
do "analysis.do"
```

Results from `reprun`

Generates report after the warning:

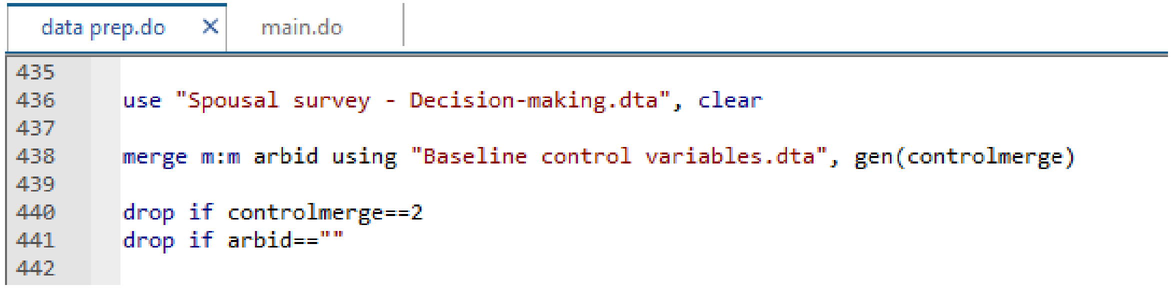


```
    reprun output created by user wb558768 at 23 Jul 2024 17:36:43
    Operating System PC (64-bit x86-64) Windows 64-bit
    Stata MP - Version 18 running as version 14.1

    Checking file:
    └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do

        |      Seed RNG State      |      Sort Order RNG      |      Data Checksum       |
 Line # |  Run 1    Run 2    Match |  Run 1    Run 2    Match |  Run 1    Run 2    Match | Loop iteration:
        |                          |                          |                          |

No mismatches and/or changes detected

    Stepping into sub-file:
    └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do
     └──> data prep.do

        |      Seed RNG State      |      Sort Order RNG      |      Data Checksum       |
 Line # |  Run 1    Run 2    Match |  Run 1    Run 2    Match |  Run 1    Run 2    Match | Loop iteration:
 438    |                          |  Change   Change   DIFF  |  Change   Change   DIFF  |
 495    |                          |  Change   Change   DIFF  |                          |
 495    |                          |  Change   Change   DIFF  |                          |
 495    |                          |  Change   Change   DIFF  |                          |
 495    |                          |  Change   Change   DIFF  |                          |
 495    |                          |  Change   Change   DIFF  |                          |

    Stepping back into file:
    └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do

        |      Seed RNG State      |      Sort Order RNG      |      Data Checksum       |
 Line # |  Run 1    Run 2    Match |  Run 1    Run 2    Match |  Run 1    Run 2    Match | Loop iteration:
 23     |                          |  Change   Change   DIFF  |  Change   Change   DIFF  |
```

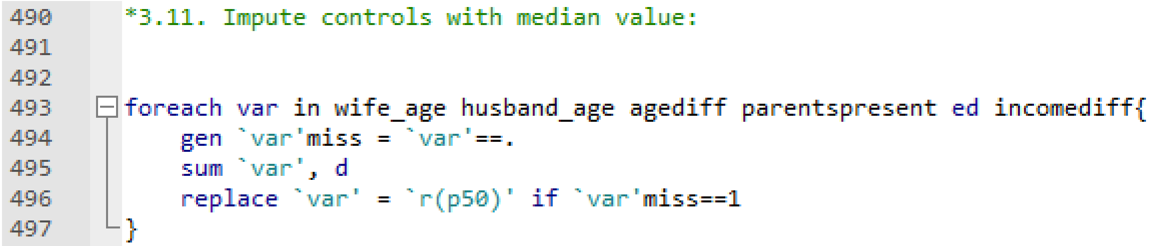


```
    Stepping into sub-file:
    └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do
    └──> analysis.do

        |      Seed RNG State      |      Sort Order RNG      |      Data Checksum       |
 Line # |  Run 1    Run 2    Match |  Run 1    Run 2    Match |  Run 1    Run 2    Match | Loop iteration:
 26     |  Change            OK!   |  Change   Change   DIFF  |                          |
 27     |                          |  Change   Change   DIFF  |                          |
 29     |                          |  Change   Change   DIFF  |                          |
 30     |                          |  Change   Change   DIFF  |                          |
 77     |                          |  Change   Change   DIFF  |                          |
 81     |                          |  Change   Change   DIFF  |                          |
 85     |                          |  Change   Change   DIFF  |                          |
 89     |                          |  Change   Change   DIFF  |                          |
 109    |                          |  Change   Change   DIFF  |                          |
 113    |                          |  Change   Change   DIFF  |                          |
 117    |                          |  Change   Change   DIFF  |                          |
 121    |                          |  Change   Change   DIFF  |                          |
 147    |                          |  Change   Change   DIFF  |                          |
 153    |                          |  Change   Change   DIFF  |                          |
 184    |                          |  Change   Change   DIFF  |                          |
 189    |                          |  Change   Change   DIFF  |                          |
 197    |                          |  Change   Change   DIFF  |                          |
 203    |                          |  Change   Change   DIFF  |                          |

    Stepping back into file:
    └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do

        |      Seed RNG State      |      Sort Order RNG      |      Data Checksum       |
 Line # |  Run 1    Run 2    Match |  Run 1    Run 2    Match |  Run 1    Run 2    Match | Loop iteration:
 24     |  Change            OK!   |  Change   Change   DIFF  |                          |

    Done checking file:
    └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do
```

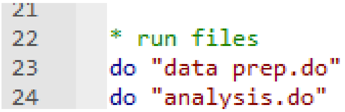
Identifying source in code



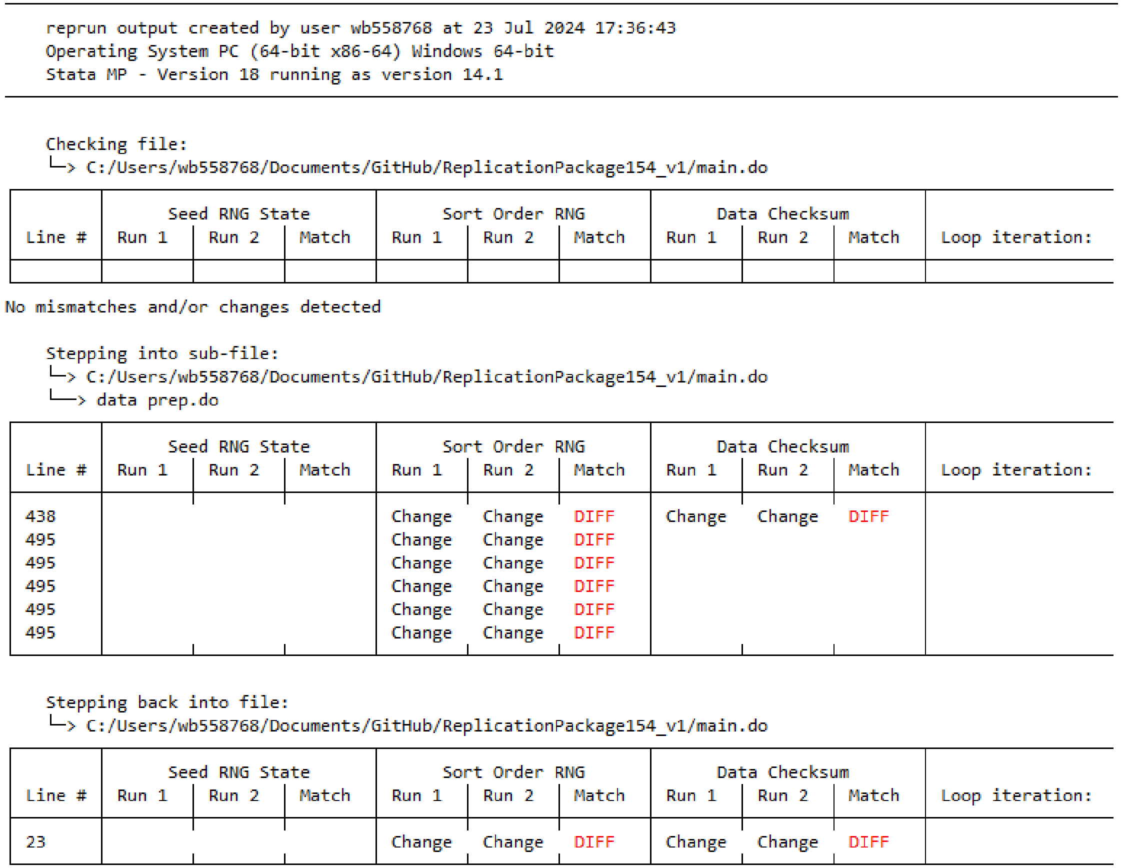
```
435
436  use "Spousal survey - Decision-making.dta", clear
437
438  merge m:m arbid using "Baseline control variables.dta", gen(controlmerge)
439
440  drop if controlmerge==2
441  drop if arbid==""
442
```



```
490  *3.11. Impute controls with median value:
491
492
493  foreach var in wife_age husband_age agediff parentspresent ed incomediff{
494      gen `var'miss = `var'==.
495      sum `var', d
496      replace `var' = `r(p50)' if `var'miss==1
497  }
```



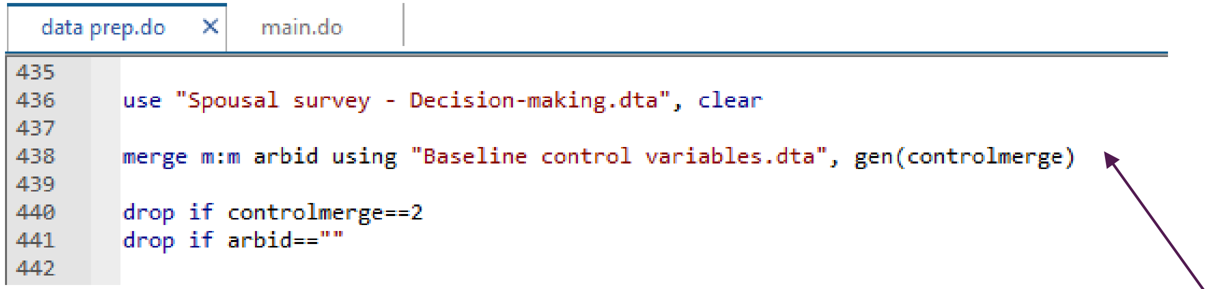
```
21
22  * run files
23  do "data prep.do"
24  do "analysis.do"
```



```
    reprun output created by user wb558768 at 23 Jul 2024 17:36:43
    Operating System PC (64-bit x86-64) Windows 64-bit
    Stata MP - Version 18 running as version 14.1

    Checking file:
    └> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do

                Seed RNG State             Sort Order RNG             Data Checksum
  Line #   Run 1    Run 2    Match    Run 1    Run 2    Match    Run 1    Run 2    Match    Loop iteration:

No mismatches and/or changes detected

    Stepping into sub-file:
    └> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do
     └──> data prep.do

                Seed RNG State             Sort Order RNG             Data Checksum
  Line #   Run 1    Run 2    Match    Run 1    Run 2    Match    Run 1    Run 2    Match    Loop iteration:

  438                                 Change   Change   DIFF     Change   Change   DIFF
  495                                 Change   Change   DIFF
  495                                 Change   Change   DIFF
  495                                 Change   Change   DIFF
  495                                 Change   Change   DIFF
  495                                 Change   Change   DIFF

    Stepping back into file:
    └> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do

                Seed RNG State             Sort Order RNG             Data Checksum
  Line #   Run 1    Run 2    Match    Run 1    Run 2    Match    Run 1    Run 2    Match    Loop iteration:

  23                                  Change   Change   DIFF     Change   Change   DIFF
```

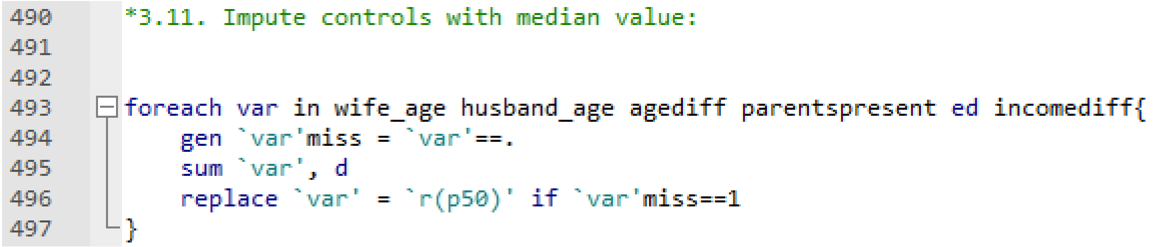
Identifying source in code

Line 438: many-to-many merge flagged



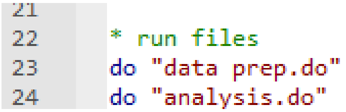
```
435
436  use "Spousal survey - Decision-making.dta", clear
437
438  merge m:m arbid using "Baseline control variables.dta", gen(controlmerge)
439
440  drop if controlmerge==2
441  drop if arbid==""
442
```

Line 495: Summary of variables from the merged dataset

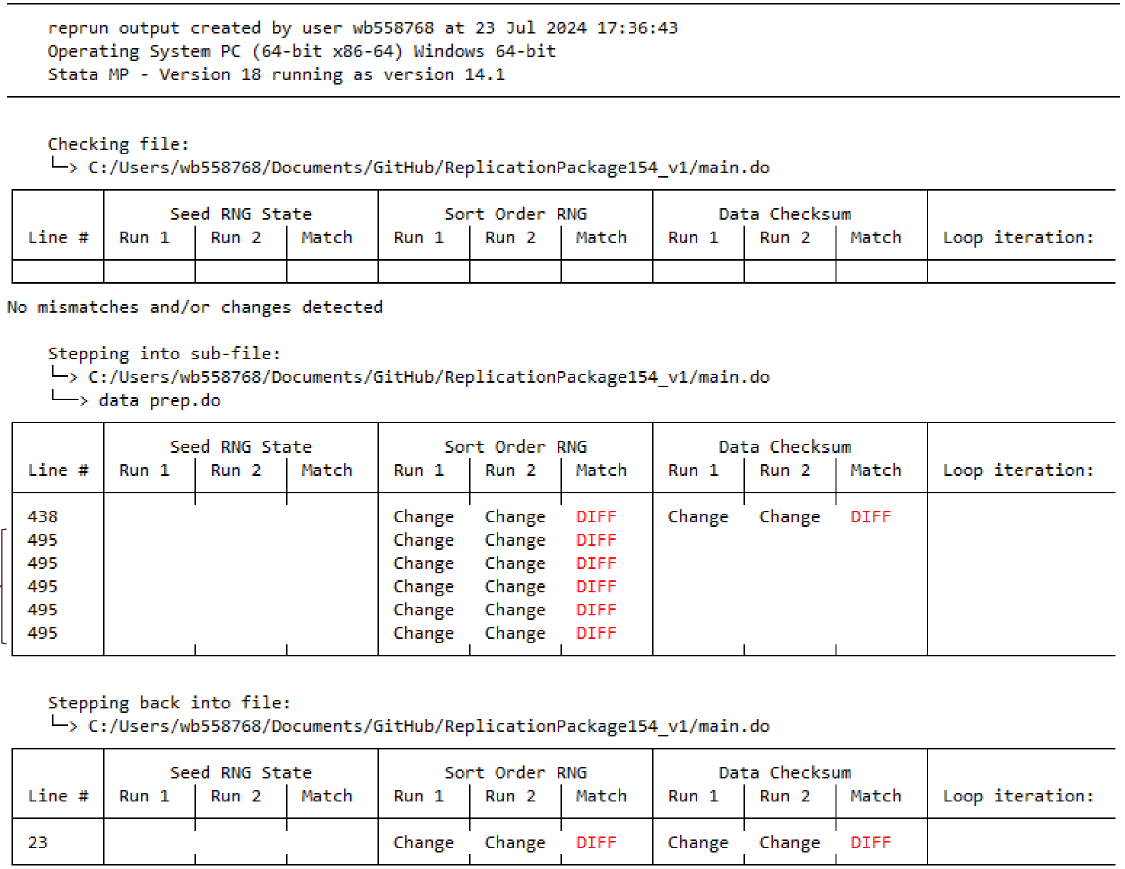


```
490  *3.11. Impute controls with median value:
491
492
493  foreach var in wife_age husband_age agediff parentspresent ed incomediff{
494      gen `var'miss = `var'==.
495      sum `var', d
496      replace `var' = `r(p50)' if `var'miss==1
497  }
```

Line 23 in main.do also flagged



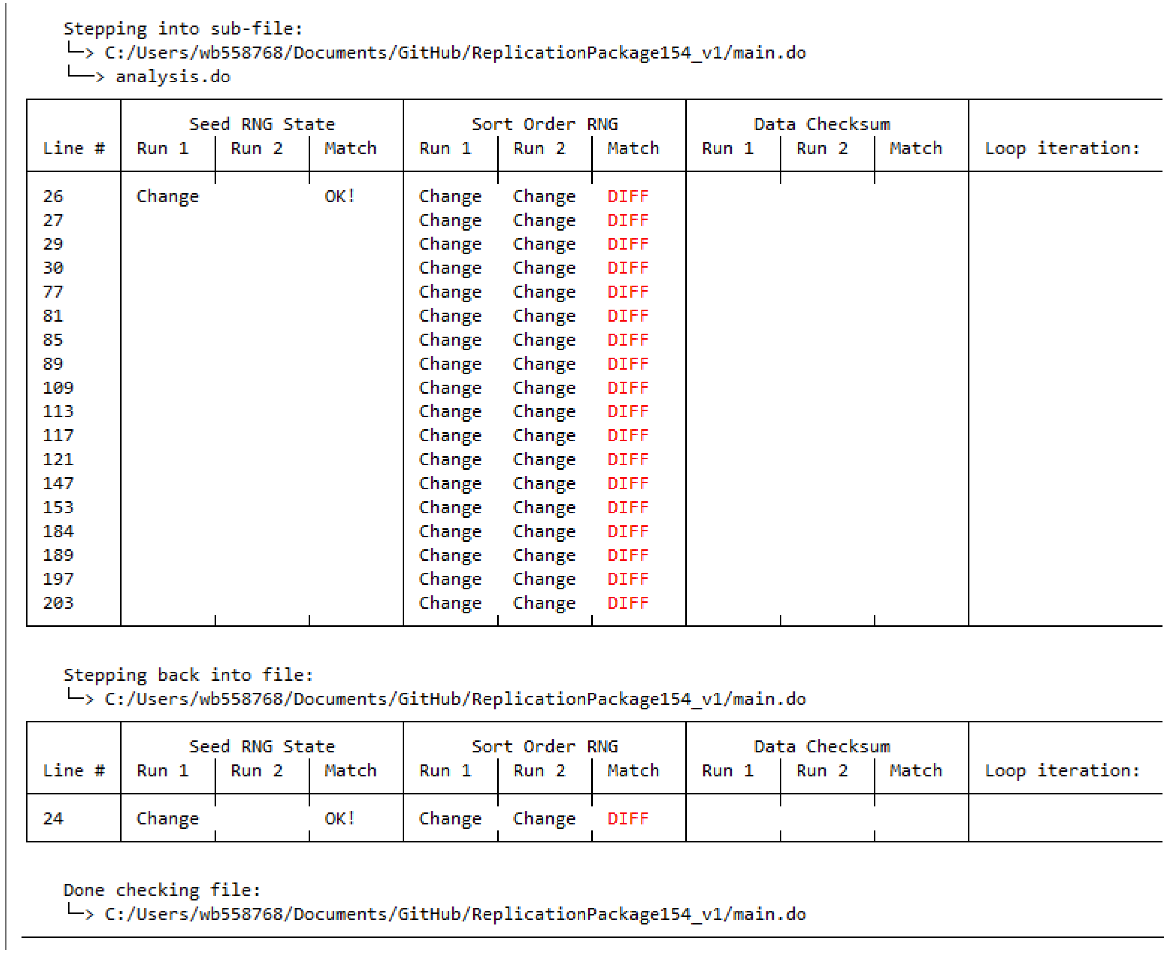
```
21
22  * run files
23  do "data prep.do"
24  do "analysis.do"
```



```
  reprun output created by user wb558768 at 23 Jul 2024 17:36:43
  Operating System PC (64-bit x86-64) Windows 64-bit
  Stata MP - Version 18 running as version 14.1

  Checking file:
  └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do

            Seed RNG State           Sort Order RNG           Data Checksum
  Line #  Run 1   Run 2   Match   Run 1   Run 2   Match   Run 1   Run 2   Match   Loop iteration:

No mismatches and/or changes detected

  Stepping into sub-file:
  └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do
   └──> data prep.do

            Seed RNG State           Sort Order RNG           Data Checksum
  Line #  Run 1   Run 2   Match   Run 1   Run 2   Match   Run 1   Run 2   Match   Loop iteration:
  438                             Change  Change  DIFF    Change  Change  DIFF
  495                             Change  Change  DIFF
  495                             Change  Change  DIFF
  495                             Change  Change  DIFF
  495                             Change  Change  DIFF
  495                             Change  Change  DIFF

  Stepping back into file:
  └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do

            Seed RNG State           Sort Order RNG           Data Checksum
  Line #  Run 1   Run 2   Match   Run 1   Run 2   Match   Run 1   Run 2   Match   Loop iteration:
  23                              Change  Change  DIFF    Change  Change  DIFF
```

Cascading instability

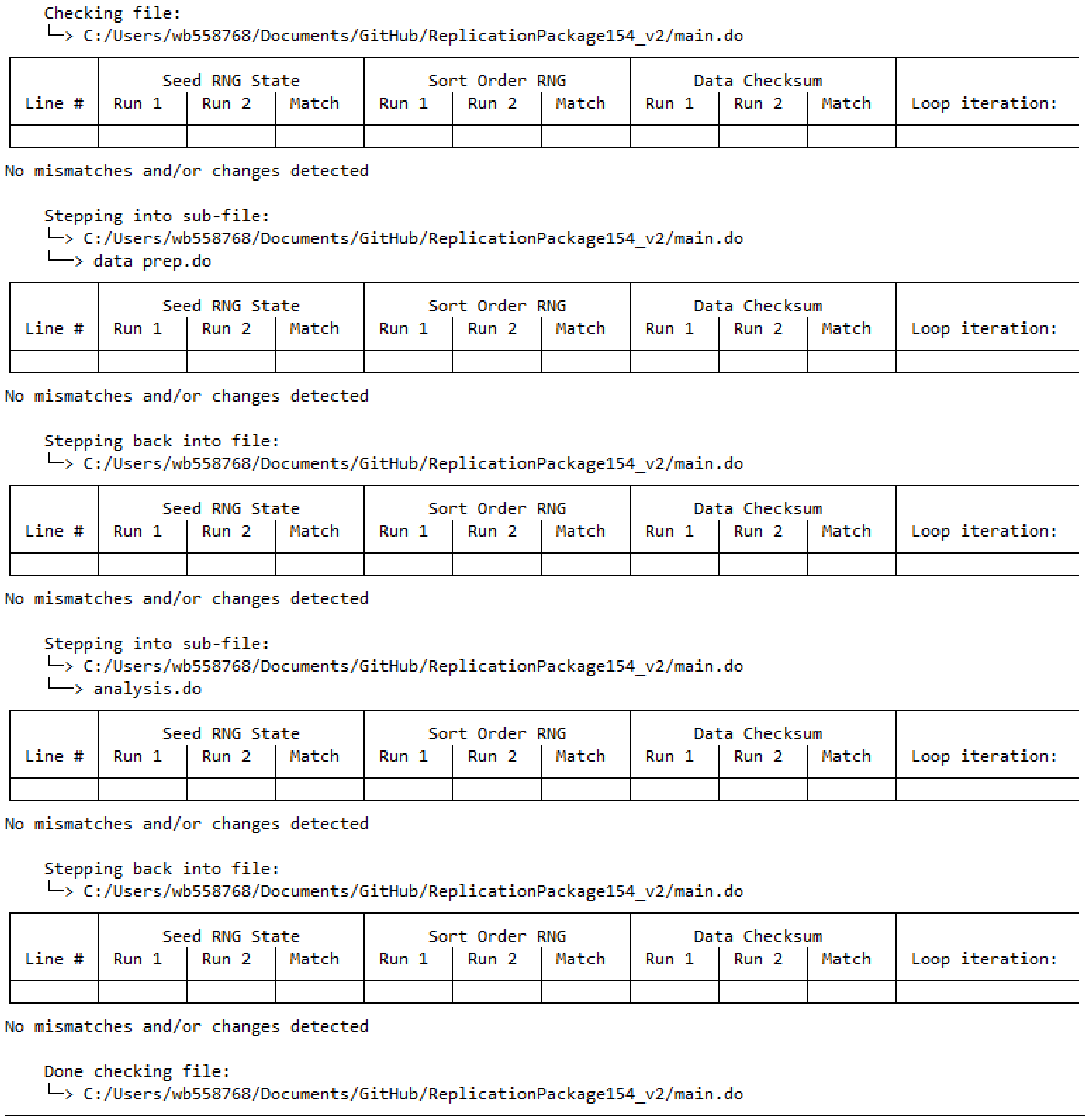
- In analysis do-file: All the lines with commands line “outreg” or “dtable” that exports or prepares the results flagged
- Analysis file flagged in main.do as well



```
Stepping into sub-file:
 └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do
 └──> analysis.do

         |      Seed RNG State      |      Sort Order RNG      |      Data Checksum       |
 Line #  |  Run 1  | Run 2  | Match |  Run 1 | Run 2  | Match |  Run 1 | Run 2  | Match | Loop iteration:
 
 26         Change           OK!      Change   Change   DIFF
 27                                   Change   Change   DIFF
 29                                   Change   Change   DIFF
 30                                   Change   Change   DIFF
 77                                   Change   Change   DIFF
 81                                   Change   Change   DIFF
 85                                   Change   Change   DIFF
 89                                   Change   Change   DIFF
 109                                  Change   Change   DIFF
 113                                  Change   Change   DIFF
 117                                  Change   Change   DIFF
 121                                  Change   Change   DIFF
 147                                  Change   Change   DIFF
 153                                  Change   Change   DIFF
 184                                  Change   Change   DIFF
 189                                  Change   Change   DIFF
 197                                  Change   Change   DIFF
 203                                  Change   Change   DIFF

Stepping back into file:
 └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do

         |      Seed RNG State      |      Sort Order RNG      |      Data Checksum       |
 Line #  |  Run 1  | Run 2  | Match |  Run 1 | Run 2  | Match |  Run 1 | Run 2  | Match | Loop iteration:

 24         Change           OK!      Change   Change   DIFF

Done checking file:
 └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v1/main.do
```

Fixing the issues

- Made the data unique and corrected the many-to-many merge to a many-to-one merge.
- Ran reprun again.
- No mismatches detected.



```
    Checking file:
    └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v2/main.do

 |        |     Seed RNG State     |     Sort Order RNG     |     Data Checksum      |                  
 | Line # | Run 1 | Run 2 | Match  | Run 1 | Run 2 | Match  | Run 1 | Run 2 | Match  | Loop iteration:  
 |        |       |       |        |       |       |        |       |       |        |                  

No mismatches and/or changes detected

    Stepping into sub-file:
    └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v2/main.do
     └──> data prep.do

 |        |     Seed RNG State     |     Sort Order RNG     |     Data Checksum      |                  
 | Line # | Run 1 | Run 2 | Match  | Run 1 | Run 2 | Match  | Run 1 | Run 2 | Match  | Loop iteration:  
 |        |       |       |        |       |       |        |       |       |        |                  

No mismatches and/or changes detected

    Stepping back into file:
    └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v2/main.do

 |        |     Seed RNG State     |     Sort Order RNG     |     Data Checksum      |                  
 | Line # | Run 1 | Run 2 | Match  | Run 1 | Run 2 | Match  | Run 1 | Run 2 | Match  | Loop iteration:  
 |        |       |       |        |       |       |        |       |       |        |                  

No mismatches and/or changes detected

    Stepping into sub-file:
    └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v2/main.do
     └──> analysis.do

 |        |     Seed RNG State     |     Sort Order RNG     |     Data Checksum      |                  
 | Line # | Run 1 | Run 2 | Match  | Run 1 | Run 2 | Match  | Run 1 | Run 2 | Match  | Loop iteration:  
 |        |       |       |        |       |       |        |       |       |        |                  

No mismatches and/or changes detected

    Stepping back into file:
    └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v2/main.do

 |        |     Seed RNG State     |     Sort Order RNG     |     Data Checksum      |                  
 | Line # | Run 1 | Run 2 | Match  | Run 1 | Run 2 | Match  | Run 1 | Run 2 | Match  | Loop iteration:  
 |        |       |       |        |       |       |        |       |       |        |                  

No mismatches and/or changes detected

    Done checking file:
    └─> C:/Users/wb558768/Documents/GitHub/ReplicationPackage154_v2/main.do
```

Key Takeaways

Ensures Reproducibility: reprun verifies that your Stata scripts produce consistent results, enhancing reliability.

Identifies Instabilities: Pinpoints specific lines and commands causing discrepancies across runs.

Simplifies Verification: Automates the process of verifying reproducibility, saving time and effort**.**

Thank you!

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