mi estimate using — Estimation using previously saved estimation results

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Description

`mi estimate using` *miestfile* is for use after `mi estimate, saving(`*miestfile*`):` .... It allows obtaining multiple-imputation (MI) estimates, including standard errors and confidence intervals, for transformed coefficients or the original coefficients, this time calculated on a subset of the imputations. The transformation can be linear or nonlinear.

Menu

Statistics > Multiple imputation

Syntax

Compute MI estimates of coefficients using previously saved estimation results

`mi estimate using` *miestfile* [`,` *options*]

Compute MI estimates of transformed coefficients using previously saved estimation results

`mi estimate` [*spec*] `using` *miestfile* [`,` *options*]

where *spec* may be one or more terms of the form `(`[*name*`:`] *exp*`)`. *exp* is any function of the parameter estimates allowed by `nlcom`; see [R] **nlcom**.

miestfile`.ster` contains estimation results previously saved by `mi estimate, saving(`*miestfile*`)`; see [MI] **mi estimate**.

options	Description
Options	
nimputations(#)	specify number of imputations to use; default is to use all existing imputations
imputations(*numlist*)	specify which imputations to use
estimations(*numlist*)	specify which estimation results to use
mcerror	compute Monte Carlo error estimates
ufmitest	perform unrestricted FMI model test
nosmall	do not apply small-sample correction to degrees of freedom
Tables	
[no]citable	suppress/display standard estimation table containing parameter-specific confidence intervals; default is citable
dftable	display degrees-of-freedom table; dftable implies nocitable
vartable	display variance information about estimates; vartable implies citable
table_options	control table output
display_options	control columns and column formats, row spacing, display of omitted variables and base and empty cells, and factor-variable labeling
Reporting	
level(#)	set confidence level; default is level(95)
dots	display dots as estimations are performed
noisily	display any output from nlcom if transformations are specified
trace	trace nlcom if transformations are specified; implies noisily
replay	replay command-specific results from each individual estimation in *miestfile*.ster; implies noisily
cmdlegend	display the command legend
nogroup	suppress summary about groups displayed for xt commands
me_options	control output from mixed-effects commands
Advanced	
errorok	allow estimation even when nlcom errors out in some imputations; such imputations are discarded from the analysis
coeflegend	display legend instead of statistics
nowarning	suppress the warning about varying estimation samples
noerrnotes	suppress error notes associated with failed estimation results in *miestfile*.ster
showimputations	show imputations saved in *miestfile*.ster
eform_option	display coefficient table in exponentiated form
post	post estimated coefficients and VCE to e(b) and e(V)

coeflegend, nowarning, noerrnotes, showimputations, *eform_option*, and post do not appear in the dialog box.

table_options	Description
noheader	suppress table header(s)
notable	suppress table(s)
nocoef	suppress table output related to coefficients
nocmdlegend	suppress command legend that appears in the presence of transformed coefficients when nocoef is used
notrcoef	suppress table output related to transformed coefficients
nolegend	suppress table legend(s)
nocnsreport	do not display constraints

See [MI] **mi estimate postestimation** for features available after estimation. To replay results, type mi estimate without arguments.

Options

Options

nimputations(#) specifies that the first # imputations be used; # must be $M_{\min} \leq \# \leq M$, where $M_{\min} = 3$ if mcerror is specified and $M_{\min} = 2$, otherwise. The default is to use all imputations, M. Only one of nimputations(), imputations(), or estimations() may be specified.

imputations(*numlist*) specifies which imputations to use. The default is to use all of them. *numlist* must contain at least two numbers corresponding to the imputations saved in *miestfile*.ster. If mcerror is specified, *numlist* must contain at least three numbers. You can use the showimputations option to display imputations currently saved in *miestfile*.ster. Only one of nimputations(), imputations(), or estimations() may be specified.

estimations(*numlist*) does the same thing as imputations(*numlist*), but this time the imputations are numbered differently. Say that *miestfile*.ster was created by mi estimate and mi estimate was told to limit itself to imputations 1, 3, 5, and 9. With imputations(), the imputations are still numbered 1, 3, 5, and 9. With estimations(), they are numbered 1, 2, 3, and 4. Usually, one does not specify a subset of imputations when using mi estimate, and so usually, the imputations() and estimations() options are identical. The specified *numlist* must contain at least two numbers. If mcerror is specified, *numlist* must contain at least three numbers. Only one of nimputations(), imputations(), or estimations() may be specified.

mcerror specifies to compute Monte Carlo error (MCE) estimates for the results displayed in the estimation, degrees-of-freedom, and variance-information tables. MCE estimates reflect variability of MI results across repeated uses of the same imputation procedure and are useful for determining an adequate number of imputations to obtain stable MI results; see White, Royston, and Wood (2011) for details and guidelines.

MCE estimates are obtained by applying the jackknife procedure to multiple-imputation results. That is, the jackknife pseudovalues of MI results are obtained by omitting one imputation at a time; see [R] **jackknife** for details about the jackknife procedure. As such, the Monte Carlo error computation requires at least three imputations.

If level() is specified during estimation, MCE estimates are obtained for confidence intervals with the specified confidence level instead of using the default 95% confidence level. If any of the options described in [R] ***eform_option*** is specified during estimation, MCE estimates for the coefficients, stan-

dard errors, and confidence intervals in the exponentiated form are also computed. `mcerror` can also be used upon replay to display MCE estimates. Otherwise, MCE estimates are not reported upon replay even if they were previously computed.

`ufmitest` specifies that the unrestricted fraction missing information (FMI) model test be used. The default test performed assumes equal fractions of information missing due to nonresponse for all coefficients. This is equivalent to the assumption that the between-imputation and within-imputation variances are proportional. The unrestricted test may be preferable when this assumption is suspect provided the number of imputations is large relative to the number of estimated coefficients.

`nosmall` specifies that no small-sample correction be made to the degrees of freedom. By default, individual tests of coefficients (and transformed coefficients) use the small-sample correction of Barnard and Rubin (1999), and the overall model test uses the small-sample correction of Reiter (2007).

Tables

All table options below may be specified at estimation time or when redisplaying previously estimated results.

`citable` and `nocitable` specify whether the standard estimation table containing parameter-specific confidence intervals is displayed. The default is `citable`. `nocitable` can be used with `vartable` to suppress the confidence interval table.

`dftable` displays a table containing parameter-specific degrees of freedom and percentages of increase in standard errors due to nonresponse. `dftable` implies `nocitable`.

`vartable` displays a table reporting variance information about MI estimates. The table contains estimates of within-imputation variances, between-imputation variances, total variances, relative increases in variance due to nonresponse, fractions of information about parameter estimates missing due to nonresponse, and relative efficiencies for using finite M rather than a hypothetically infinite number of imputations. `vartable` implies `citable`.

table_options control the appearance of all displayed table output:

`noheader` suppresses all header information from the output. The table output is still displayed.

`notable` suppresses all tables from the output. The header information is still displayed.

`nocoef` suppresses the display of tables containing coefficient estimates. This option affects the table output produced by `citable`, `dftable`, and `vartable`.

`nocmdlegend` suppresses the table legend showing the command line, used to produce results in *miestfile*`.ster`, from the output. This legend appears above the tables containing transformed coefficients (or above the variance-information table if `vartable` is used) when `nocoef` is specified.

`notrcoef` suppresses the display of tables containing estimates of transformed coefficients (if specified). This option affects the table output produced by `citable`, `dftable`, and `vartable`.

`nolegend` suppresses all table legends from the output.

`nocnsreport`; see [R] **Estimation options**.

display_options: `noci`, `nopvalues`, `noomitted`, `vsquish`, `noemptycells`, `baselevels`, `allbaselevels`, `nofvlabel`, `fvwrap(#)`, `fvwrapon(`*style*`)`, `cformat(%`*fmt*`)`, `pformat(%`*fmt*`)`, and `sformat(%`*fmt*`)`; see [R] **Estimation options**.

Reporting

`level(#)`; see [R] **Estimation options**.

dots specifies that dots be displayed as estimations of transformed coefficients are successfully completed. An x is displayed if nlcom fails to estimate one of the transformed coefficients specified in *spec*. This option is relevant only if transformations are specified.

noisily specifies that any output from nlcom, used to obtain the estimates of transformed coefficients, be displayed. This option is relevant only if transformations are specified.

trace traces the execution of nlcom. trace implies noisily and is relevant only if transformations are specified.

replay replays estimation results from *miestfile*.ster, previously saved by mi estimate, saving(*miestfile*). This option implies noisily.

cmdlegend requests that the command line corresponding to the estimation command used to produce the estimation results saved in *miestfile*.ster be displayed. cmdlegend may be specified at run time or when redisplaying results.

nogroup suppresses the display of group summary information (number of groups, average group size, minimum, and maximum) as well as other command-specific information displayed for xt commands.

me_options: stddeviations, variance, noretable, nofetable, and estmetric. These options are relevant only with the mixed-effects command mixed (see [ME] **mixed**). See the corresponding mixed-effects commands for more information. The stddeviations option is the default with mi estimate using, because MI-based confidence intervals may not be computable for some random-effects variances and covariances; see help mi_me_note for details. The estmetric option is implied when vartable or dftable is used.

Advanced

errorok specifies that estimations of transformed coefficients that fail be skipped and the combined results be based on the successful estimation results. The default is that mi estimate stops if an individual estimation fails. If the *miestfile*.ster file contains failed estimation results, mi estimate using does not error out; it issues notes about which estimation results failed and discards these estimation results in the computation. You can use the noerrnotes option to suppress the display of the notes.

The following options are available with mi estimate using but are not shown in the dialog box:

coeflegend; see [R] **Estimation options**. coeflegend implies nocitable and cannot be combined with citable or dftable.

nowarning suppresses the warning message at the bottom of table output that occurs if the estimation sample varies and esampvaryok is specified. See *Potential problems that can arise when using mi estimate* in [MI] **mi estimate** for details.

noerrnotes suppresses notes about failed estimation results. These notes appear when *miestfile*.ster contains estimation results, previously saved by mi estimate, saving(*miestfile*), from imputations for which the estimation command used with mi estimate failed to estimate parameters.

showimputations displays imputation numbers corresponding to the estimation results saved in *miestfile*.ster. showimputations may be specified at run time or when redisplaying results.

eform_option; see [R] ***eform_option***. `mi estimate using` reports results in the coefficient metric under which the combination rules are applied. You may use the appropriate *eform_option* to redisplay results in exponentiated form, if desired. If `dftable` is also specified, the reported degrees of freedom and percentage increases in standard errors are not adjusted and correspond to the original coefficient metric.

`post` requests that MI estimates of coefficients and their respective VCEs be posted in the usual way. This allows the use of *estimation_command*-specific postestimation tools with MI estimates. There are issues; see *Using the command-specific postestimation tools* in [MI] **mi estimate postestimation**. `post` may be specified at estimation time or when redisplaying previously estimated results.

Remarks and examples

`mi estimate using` is convenient when refitting models using `mi estimate` would be tedious or time consuming. In such cases, you can perform estimation once and save the uncombined, individual results by specifying `mi estimate`'s `saving(`*miestfile*`)` option. After that, you can repeatedly use `mi estimate using` *miestfile* to estimate linear and nonlinear transformations of coefficients or to obtain MI estimates using a subset of saved imputations.

`mi estimate using` performs the pooling step of the MI procedure; see [MI] **Intro substantive**. That is, it combines completed-data estimates from the *miestfile*`.ster` file by applying Rubin's combination rules (Rubin 1987, 77).

▷ Example 1

Recall the analysis of house resale prices from *Example 2: Completed-data linear regression analysis* in [MI] **mi estimate**:

```
. use https://www.stata-press.com/data/r19/mhouses1993s30
(Albuquerque home prices Feb15-Apr30, 1993)
. mi estimate, saving(miest): regress price tax sqft age nfeatures ne custom
> corner
Multiple-imputation estimates                   Imputations       =         30
Linear regression                               Number of obs     =        117
                                                Average RVI       =     0.0648
                                                Largest FMI       =     0.2533
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      69.12
                                                        avg       =      94.02
                                                        max       =     105.51
Model F test:       Equal FMI                   F(   7,  106.5)   =      67.18
Within VCE type:          OLS                   Prob > F          =     0.0000
------------------------------------------------------------------------------
       price | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
         tax |   .6768015   .1241568     5.45   0.000     .4301777    .9234253
        sqft |   .2118129    .069177     3.06   0.003     .0745091    .3491168
         age |   .2471445   1.653669     0.15   0.882    -3.051732    3.546021
    nfeatures |   9.288033   13.30469     0.70   0.487    -17.12017    35.69623
          ne |   2.518996   36.99365     0.07   0.946    -70.90416    75.94215
      custom |   134.2193   43.29755     3.10   0.002     48.35674    220.0818
      corner |  -68.58686    39.9488    -1.72   0.089    -147.7934    10.61972
       _cons |   123.9118   71.05816     1.74   0.085    -17.19932    265.0229
------------------------------------------------------------------------------
```

In the above, we use the `saving()` option to save the individual completed-data estimates from a regression analysis in Stata estimation file `miest.ster`. We can now use `mi estimate using` to recombine the first 5 imputations, and ignore the remaining 25, without reestimation:

```
. mi estimate using miest, ni(5)
Multiple-imputation estimates                   Imputations       =          5
Linear regression                               Number of obs     =        117
                                                Average RVI       =     0.0685
                                                Largest FMI       =     0.2075
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      48.59
                                                        avg       =      85.22
                                                        max       =     104.79
Model F test:       Equal FMI                   F(   7,  103.9)   =      67.50
Within VCE type:          OLS                   Prob > F          =     0.0000
```

price	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
tax	.6631356	.122443	5.42	0.000	.4195447	.9067265
sqft	.2185884	.0670182	3.26	0.002	.0856051	.3515718
age	-.0395402	1.613185	-0.02	0.981	-3.28205	3.202969
nfeatures	8.735622	13.42251	0.65	0.517	-18.01198	35.48323
ne	4.069381	36.94491	0.11	0.913	-69.4355	77.57426
custom	130.4925	42.93286	3.04	0.003	45.36257	215.6225
corner	-71.25406	40.06697	-1.78	0.078	-150.7152	8.207084
_cons	130.2002	70.38012	1.85	0.068	-9.624642	270.025

We obtain results identical to those shown in the example in [MI] **mi estimate**.

We can also obtain estimates of transformed coefficients without refitting the models to the imputed dataset. Recall the example from *Example 5: Estimating transformations* in [MI] **mi estimate**, where we estimated the ratio of the coefficients for `age` and `sqft`. We can obtain the same results by using the following:

```
. mi estimate (ratio: _b[age]/_b[sqft]) using miest
Multiple-imputation estimates                   Imputations       =         30
Linear regression                               Number of obs     =        117
                                                Average RVI       =     0.0648
                                                Largest FMI       =     0.2533
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      69.12
                                                        avg       =      94.02
                                                        max       =     105.51
Model F test:       Equal FMI                   F(   7,  106.5)   =      67.18
Within VCE type:          OLS                   Prob > F          =     0.0000
------------------------------------------------------------------------------
       price | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
         tax |   .6768015   .1241568     5.45   0.000     .4301777    .9234253
        sqft |   .2118129    .069177     3.06   0.003     .0745091    .3491168
         age |   .2471445   1.653669     0.15   0.882    -3.051732    3.546021
   nfeatures |   9.288033   13.30469     0.70   0.487    -17.12017    35.69623
          ne |   2.518996   36.99365     0.07   0.946    -70.90416    75.94215
      custom |   134.2193   43.29755     3.10   0.002     48.35674    220.0818
      corner |  -68.58686    39.9488    -1.72   0.089    -147.7934    10.61972
       _cons |   123.9118   71.05816     1.74   0.085    -17.19932    265.0229
------------------------------------------------------------------------------

Transformations                                 Average RVI       =     0.2899
                                                Largest FMI       =     0.2316
                                                Complete DF       =        109
DF adjustment:   Small sample                   DF:     min       =      72.51
                                                        avg       =      72.51
Within VCE type:          OLS                   max       =      72.51
        ratio: _b[age]/_b[sqft]
------------------------------------------------------------------------------
       price | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
       ratio |    1.44401   8.217266     0.18   0.861    -14.93485    17.82287
------------------------------------------------------------------------------
```

The results are the same as in the example in [MI] **mi estimate**.

◁

For more examples, see [MI] **mi test**.

Stored results

See *Stored results* in [MI] **mi estimate**.

Methods and formulas

See *Methods and formulas* in [MI] **mi estimate**.

References

Barnard, J., and D. B. Rubin. 1999. Small-sample degrees of freedom with multiple imputation. *Biometrika* 86: 948–955. https://doi.org/10.1093/biomet/86.4.948.

Reiter, J. P. 2007. Small-sample degrees of freedom for multi-component significance tests with multiple imputation for missing data. *Biometrika* 94: 502–508. https://doi.org/10.1093/biomet/asm028.

Rubin, D. B. 1987. *Multiple Imputation for Nonresponse in Surveys*. New York: Wiley.

White, I. R., P. Royston, and A. M. Wood. 2011. Multiple imputation using chained equations: Issues and guidance for practice. *Statistics in Medicine* 30: 377–399. https://doi.org/10.1002/sim.4067.

Also see

[MI] **mi estimate** — Estimation using multiple imputations

[MI] **mi estimate postestimation** — Postestimation tools for mi estimate

[MI] **Intro** — Introduction to mi

[MI] **Intro substantive** — Introduction to multiple-imputation analysis

[MI] **Glossary**

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