Title

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estat df — Calculate degrees of freedom for fixed effects

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Description

`estat df` is for use after estimation with `mixed`.

`estat df` calculates and displays the degrees of freedom (DF) for each fixed effect using the specified methods. This allows for a comparison of different DF methods. `estat df` can also be used to continue with postestimation using a different DF method without rerunning the model.

Menu for estat

Statistics > Postestimation

Syntax

```
estat df [ , method(df_methods) post[ (df_method) ] eim oim ]
```

`collect` is allowed; see [U] **11.1.10 Prefix commands**.

Options

`method(`*df_methods*`)` specifies a list of methods to compute DF. The supported methods are `residual`, `repeated`, `anova`, `satterthwaite`, and `kroger`; more than one method may be specified. Methods `satterthwaite` and `kroger` are only available with REML estimation. If option `dfmethod()` was not specified in the most recently fit `mixed` model, then option `method()` is required. See *Small-sample inference for fixed effects* under *Remarks and examples* in [ME] **mixed** for more details.

`post` causes `estat df` to behave like a Stata estimation command. When `post` is specified, `estat df` will post the DF for each fixed effect as well as everything related to the DF computation to `e()` for the method specified in `method()`. Thus, after posting, you could continue to use this DF for other postestimation commands. For example, you could use `test, small` to perform Wald F tests on linear combination of the fixed effects.

`post` may also be specified using the syntax `post(`*df_method*`)`. You must use this syntax if you specify multiple *df_methods* in option `method()`. With this syntax, `estat df` computes the DF using the method specified in `post()` and stores the results in `e()`. Only one computation method may be specified using the syntax `post()`.

The *df_method* specified in `post()` must be one of the DF methods specified in option `method()`. If only one method is specified in option `method()`, then one can simply use `post` to make this DF method active for postestimation and for `mixed` replay.

`eim` specifies that the expected information matrix be used in the DF computation. It can be used only when `method()` contains `kroger` or `satterthwaite`. `eim` is the default.

oim specifies that the observed information matrix be used in the DF computation. It can be used only when method() contains kroger or satterthwaite.

Remarks and examples

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▷ Example 1: Changing the degrees of freedom method

To illustrate the use of estat df, we refit the dental veneer data from example 14 of [ME] **mixed** using the Kenward–Roger method (option dfmethod(kroger)) to compute the DF for fixed effects.

```
. use https://www.stata-press.com/data/r18/veneer
(Dental veneer data)
. mixed gcf followup base_gcf cda age || patient: followup,
> covariance(unstructured) || tooth:, reml nolog dfmethod(kroger)
Mixed-effects REML regression                   Number of obs =    110
        Grouping information
------------------------------------------------------------------------------
 Group variable |     No. of       Observations per group
                |     groups    Minimum    Average    Maximum
----------------+-------------------------------------------------------------
        patient |         12          2        9.2         12
          tooth |         55          2        2.0          2
------------------------------------------------------------------------------
DF method: Kenward-Roger                                DF:       min =  10.41
                                                                  avg =  28.96
                                                                  max =  50.71
                                                        F(4, 27.96)   =   1.47
Log restricted-likelihood = -420.92761                  Prob > F      = 0.2370
------------------------------------------------------------------------------
         gcf | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
    followup |   .3009815   1.938641     0.16   0.879    -3.96767    4.569633
    base_gcf |  -.0183127   .1466261    -0.12   0.901    -.3132419    .2766164
         cda |   -.329303   .5533506    -0.60   0.554    -1.440355    .7817493
         age |  -.5773932   .2350491    -2.46   0.033    -1.098324   -.056462
       _cons |   45.73862   13.21824     3.46   0.002     18.53866    72.93858
------------------------------------------------------------------------------

------------------------------------------------------------------------------
  Random-effects parameters |   Estimate   Std. err.      [95% conf. interval]
----------------------------+-------------------------------------------------
patient: Unstructured       |
                 var(followup) |   41.88772   18.79997       17.38009    100.9535
                    var(_cons) |   524.9851   253.0205       204.1287    1350.175
          cov(followup,_cons) |  -140.4229   66.57623      -270.9099   -9.935904
----------------------------+-------------------------------------------------
tooth: Identity             |
                    var(_cons) |   47.45738   16.63034        23.8792    94.3165
----------------------------+-------------------------------------------------
                 var(Residual) |   48.86704   10.50523       32.06479    74.47382
------------------------------------------------------------------------------
LR test vs. linear model: chi2(4) = 91.12                 Prob > chi2 = 0.0000
Note: LR test is conservative and provided only for reference.
```

Rather than specifying option `dftable(pvalue)` or `dftable(ci)` at estimation, we can display the covariate-specific DFs during postestimation by typing

```
. estat df
Degrees of freedom
```

	Kenward-Roger
gcf	
followup	10.96355
base_gcf	47.2708
cda	50.70932
age	10.41127
_cons	25.43377

`estat df` can also compare different DF methods using the `method()` option. For example, we can compare the Kenward–Roger method with the Satterthwaite method by typing

```
. estat df, method(kroger satterthwaite)
Degrees of freedom
```

	Kenward-Roger	Satterthwaite
gcf		
followup	10.96355	10.96355
base_gcf	47.2708	47.2708
cda	50.70932	50.70932
age	10.41127	10.41127
_cons	25.43377	25.43377

The two methods produce the same estimates of DFs for single-hypothesis tests, but the results differ for multiple-hypotheses tests; see example 4 of [ME] **mixed postestimation** for details.

Suppose that we decide to proceed with the Satterthwaite method in subsequent analysis. Rather than retyping our `mixed` command with the `dfmethod(satterthwaite)` option, we can post the Satterthwaite DFs using the `post` option of `estat df`.

```
. estat df, method(satterthwaite) post
Degrees of freedom
```

	Satterthwaite
gcf	
followup	10.96355
base_gcf	47.2708
cda	50.70932
age	10.41127
_cons	25.43377

The returned values associated with `dfmethod(kroger)` from the `mixed` command will be replaced with those of `dfmethod(satterthwaite)`.

◁

Stored results

`estat df` stores the following in `r()`:

Macros

`r(dfmethods)`	DF methods

Matrices

`r(df)`	parameter-specific DFs for each method specified in `method()`
`r(V_df)`	variance–covariance matrix of the estimators when `kroger` method is specified

If `post()` is specified, `estat df` also stores the following in `e()`:

Scalars

`e(F)`	overall F test statistic for the method specified in `post()`
`e(ddf_m)`	model DDF for the method specified in `post()`
`e(df_max)`	maximum DF for the method specified in `post()`
`e(df_avg)`	average DF for the method specified in `post()`
`e(df_min)`	minimum DF for the method specified in `post()`

Macros

`e(dfmethod)`	DF method specified in `post()`
`e(dftitle)`	title for DF method

Matrices

`e(df)`	parameter-specific DFs for the method specified in `post()`
`e(V_df)`	variance–covariance matrix of the estimators when `kroger` method is posted

Also see

[ME] **mixed** — Multilevel mixed-effects linear regression

[U] 20 Estimation and postestimation commands

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