Running MIXREGLS from within Stata: the `runmixregls` command

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What is `runmixregls`?

- `runmixregls` is a new **Stata** command to run the **MIXREGLS** mixed-effects location scale software (Hedeker and Nordgren, 2013) seamlessly from within **Stata**

- The **mixed-effects location scale model** extends the standard two-level random-intercept multilevel model for continuous data by...

  1. Modelling the within- and between-group variances as log linear functions of the covariates

  2. Including a ‘random-scale effect’ in the within-group variance function to account for unexplained heterogeneity of variance across groups

- This model, while an appealing and conceptually simple extension, cannot otherwise be fitted in Stata or easily in any other software
MIXED-EFFECTS LOCATION SCALE MODEL
The standard two-level random-intercept multilevel model

To understand the mixed-effects location scale model, first consider the two-level random-intercept multilevel model for continuous data, written for simplicity in terms of a single covariate at each level of analysis

\[ y_{ij} = \beta_0 + \beta_1 x_{ij} + \beta_2 w_j + u_j + e_{ij} \]

\[ u_j \sim N(0, \sigma_u^2) \]

\[ e_{ij} \sim N(0, \sigma_e^2) \]

where

- \( y_{ij} \) is the continuous response variable
- \( x_{ij} \) is the observation-level covariate
- \( w_j \) is the group-level covariate
- \( u_j \) is the group random-intercept effect with **between-group variance** \( \sigma_u^2 \)
- \( e_{ij} \) is the residual-error with **within-group variance** \( \sigma_e^2 \)
A reparameterization of the standard model

- We can reparameterise the previous model as

Mean function

\[ y_{ij} = \beta_0 + \beta_1 x_{ij} + \beta_2 w_j + \sigma_u \theta_{1j} + e_{ij} \]

Between-group variance function

\[ \log(\sigma_u^2) = \alpha_0 \]

Within-group variance function

\[ \log(\sigma_e^2) = \gamma_0 \]

\[ \theta_{1j} \sim N(0,1) \]

\[ e_{ij} \sim N(0, \sigma_e^2) \]

where

- \( \sigma_u \) is the square root of the between-group variance
- \( \theta_{1j} \) is the standardised group random-intercept effect
- \( \alpha_0 \) is the log of the between-group variance
- \( \gamma_0 \) is the log of the within-group variance
- \( \sigma_w, \sigma_u^2 \) and \( \sigma_e^2 \) are all ‘intermediate parameters’
Including covariates in the variance functions

- We can then add covariates into the within- and between-group variance functions

**Mean**

\[ y_{ij} = \beta_0 + \beta_1 x_{ij} + \beta_2 w_j + \sigma_{uj} \theta_{1j} + e_{ij} \]

**Between**

\[ \log \left( \sigma_{uj}^2 \right) = \alpha_0 + \alpha_1 x_{ij} + \alpha_2 w_j \]

**Within**

\[ \log \left( \sigma_{ej}^2 \right) = \gamma_0 + \gamma_1 x_{ij} + \gamma_2 w_j \]

\[ \theta_{1j} \sim \text{N}(0,1) \]

\[ e_{ij} \sim \text{N} \left( 0, \sigma_{ej}^2 \right) \]

- An interesting feature of this parameterisation is that we can include level-1 covariates in the between-group variance function
Including a random-scale effect

- We can also include a **'random-scale effect'** in the within-group variance function to allow for any remaining heterogeneity of variance across groups.

**Mean**

\[ y_{ij} = \beta_0 + \beta_1 x_{ij} + \beta_2 w_j + \sigma_{u_{ij}} \theta_{1j} + e_{ij} \]

**Between**

\[ \log\left( \sigma^2_{u_{ij}} \right) = \alpha_0 + \alpha_1 x_{ij} + \alpha_2 w_j \]

**Within**

\[ \log\left( \sigma^2_{e_{ij}} \right) = \gamma_0 + \gamma_1 x_{ij} + \gamma_2 w_j + \sigma_v \theta_{2j} \]

\[ \theta_{1j} \sim N(0, 1) \]

\[ \theta_{2j} \sim N(0, 1) \]

\[ e_{ij} \sim N\left(0, \sigma^2_{e_{ij}}\right) \]

- We now refer to \( \theta_{1j} \) as the **'random-location effect'**.
Allowing an association between the location and the scale

- Finally, we can allow for a **group-level association between the location and scale** by further modelling the log of the within-group variance as a linear or quadratic function of the random-location effect

\[
\text{Mean} \quad y_{ij} = \beta_0 + \beta_1 x_{ij} + \beta_2 w_j + \sigma_u \theta_{1j} + e_{ij}
\]

\[
\text{Between} \quad \log \left( \sigma_u^2 \right) = \alpha_0 + \alpha_1 x_{ij} + \alpha_2 w_j
\]

\[
\text{Within} \quad \log \left( \sigma_e^2 \right) = \gamma_0 + \gamma_1 x_{ij} + \gamma_2 w_j + \delta_l \theta_{1j} + \delta_q \theta_{1j}^2 + \sigma_v \theta_{2j}
\]

\[
\theta_{1j} \sim \mathcal{N}(0,1)
\]

\[
\theta_{2j} \sim \mathcal{N}(0,1)
\]

\[
e_{ij} \sim \mathcal{N} \left( 0, \sigma_e^2 \right)
\]

- When linear is chosen, this is equivalent to bivariate normal random effects
Installing `runmixregls`

- The `runmixregls` command requires **Stata** 12 or later and **MIXREGLS**.
- **MIXREGLS** can be freely downloaded from
- `runmixregls` can be installed from the Statistical Software Components (SSC) archive by typing the following command within a net-aware version of **Stata**
  ```
  . ssc install runmixregls
  ```
- Next, you must declare the fully qualified path and filename for the **MIXREGLS** executable (the **MIXREGLS** .exe file) so that `runmixregls` knows where to find the software. You can do this by specifying a `global` macro called `mixreglspath`. For example
  ```
  . global mixreglspath "C:\MIXREGLS\mixreglslsb.exe"
  ```
EXAMPLE:
REISBY DEPRESSION DATA

Patients were diagnosed at baseline with either endogenous (N = 37) or non-endogenous (N = 29) depression and were then rated weekly using the Hamilton depression rating scale (range = 0 to 39).

The data consists of 375 observations (level-1) on 66 subjects (level-2).

Response is Hamilton depression score (hamdep).

Main covariates are week number (week), depression group (endog), and the interaction between group and week (endweek).
2-user 2-core Stata network perpetual license:
Serial number: 50120527735
Licensed to: ZoneA
    University of Bristol

Notes:
1. (/v# option or -set maxvar-) 5000 maximum variables

running C:\Program Files (x86)\Stata12\sysprofile.do ...

running C:\Users\gl1918\profile.do ...

2-user 2-core Stata network perpetual license:
Serial number: 50120527735
Licensed to: ZoneA
University of Bristol

Notes:
1. (/v# option or -set maxvar-) 5000 maximum variables
running C:\Program Files (x86)\Stata12\sysprofile.do ...
running C:\Users\gl9158\profile.do ...

use http://www.bristol.ac.uk/cmm/media/runmixregls/riesby, clear
use http://www.bristol.ac.uk/cmm/media/runmixregls/riesby.dta

Notes:
1. (/v# option or -set maxvar-) 5000 maximum variables

running C:\Program Files (x86)\Stata12\sysprofile.do ...

running C:\Users\gl19188\profile.do ...

.use http://www.bristol.ac.uk/cmm/media/runmixregls/riesby, clear
2-user 2-core Stata network perpetual license:
  Serial number:  50120527735
  Licensed to:  ZoneA
                  University of Bristol

Notes:
  1.  (/v# option or -set maxvar-) 5000 maximum variables

running C:\Program Files (x86)\Stata12\sysprofile.do ...

running C:\Users\gl9158\profile.do ...

.  use http://www.bristol.ac.uk/cmm/media/runmixregls/riesby, clear

.
Spaghetti plot, by depression group

Graphs by Endogenous

```
twoway (line hamdep week, connect(ascending)),
> xlabel(0(1)5) by(endog)
```
Mixed-effects location scale model

- Hedeker and Nordgren (2013, p. 11) fit the following mixed-effects location scale model to these data

\[
\text{hamdep}_{ij} = \beta_0 + \beta_1 \text{week}_{ij} + \beta_2 \text{endog}_j + \beta_2 \text{endweek}_{ij} + \sigma_u \theta_{1j} + e_{ij}
\]

\[
\log (\sigma^2_{u_j}) = \alpha_0 + \alpha_1 \text{endog}_j
\]

\[
\log (\sigma^2_{e_{ij}}) = \gamma_0 + \gamma_1 \text{week}_{ij} + \gamma_2 \text{endog}_j + \delta_l \theta_{1j} + \sigma_v \theta_{2j}
\]

\[
\theta_{1j} \sim \text{N}(0,1)
\]

\[
\theta_{2j} \sim \text{N}(0,1)
\]

\[
e_{ij} \sim \text{N}(0, \sigma^2_{e_{ij}})
\]

- From eyeballing the spaghetti plot, we might expect:
  \[
  \beta_0 \approx 25, \beta_1 \approx -3, \beta_2 > 0, \beta_3 \approx ?, \alpha_0 \approx ?, \alpha_1 > 0, \gamma_0 \approx ?, \gamma_1 > 0, \gamma_2 \approx ?, \delta_l \approx ?, \sigma_v > 0
  \]
The `runmixregls` command syntax

\[ \text{hamdep}_{ij} = \beta_0 + \beta_1 \text{week}_{ij} + \beta_2 \text{endog}_j + \beta_3 \text{endweek}_{ij} + \sigma_{u_j} \theta_{1j} + e_{ij} \]

\[ \log(\sigma^2_{u_j}) = \alpha_0 + \alpha_1 \text{endog}_j \]

\[ \log(\sigma^2_{e_{ij}}) = \gamma_0 + \gamma_1 \text{week}_{ij} + \gamma_2 \text{endog}_j + \delta_1 \theta_{1j} + \sigma_v \theta_{2j} \]

\[ \theta_{1j} \sim N(0,1) \]

\[ \theta_{2j} \sim N(0,1) \]

\[ e_{ij} \sim N(0, \sigma^2_{e_{ij}}) \]

```
runmixregls hamdep week endog endweek, ///
    between(endog) ///
    within(week endog)
```
Statistics/Data Analysis

MP - Parallel Edition

Copyright 1985-2011 StataCorp LP
StataCorp
4905 Lakeway Drive
College Station, Texas 77845 USA
800-STATA-PC http://www.stata.com
979-696-4600 stata@stata.com
979-696-4601 (fax)

2-user 2-core Stata network perpetual license:
Serial number: 50120527735
Licensed to: ZoneA
University of Bristol

Notes:
1. (/v# option or -set maxvar-) 5000 maximum variables

running C:\Program Files (x86)\Stata12\sysprofile.do ...

running C:\Users\gl9158\profile.do ...

use http://www.bristol.ac.uk/cmm/media/runmixregrls/riesby, clear

recode hamdep (-9.=.)
(hamdep: 21 changes made)

xtset id
panel variable: id (balanced)

runmixregrls hamdep week endog endweek, between(endog) within(week endog)
Model WITH RANDOM Scale

Newton-Raphson Iteration maximum correction and derivative
1 with ridge 0.2000
  0.46136826641892137 25.881273290225710
-2 Log-Likelihood = 2259.10311
Newton-Raphson Iteration maximum correction and derivative
2 with ridge 0.2000
  0.18153386359866155 9.0841299459903713
-2 Log-Likelihood = 2248.75141
Newton-Raphson Iteration maximum correction and derivative
3 with ridge 0.2000
  0.14724263710334884 5.8593555695932160
-2 Log-Likelihood = 2246.33979
Newton-Raphson Iteration maximum correction and derivative
4 with ridge 0.2000
  9.381031020326516E-002 3.8530440918281297
-2 Log-Likelihood = 2245.39734
Newton-Raphson Iteration maximum correction and derivative
5 with ridge 0.2000
  5.722447258925404E-002 2.5457851727048340
-2 Log-Likelihood = 2245.00291

1. HAMDEP recode.

. use http://example.com/data
.
. recode hamdep (-9=.)
  (hamdep: 21 changes made)
.
. xtset id
  panel variable: id (balanced)
.
runmixregls hamdep week endog endweek, between(endog) within(week endog)
. use http://www.bristol.ac.uk/cmm/media/runmixregls/riesby.dta, clear

. recode hamdep (-9=.)
   (hamdep: 21 changes made)

. xtset id
   panel variable: id (balanced)

. runmixregls hamdep week endog endweek, between(endog) within(week endog)

runmixregls - Run MIXREGLS from within Stata

Mixed-effects location scale model
Number of obs = 375
Number of groups = 66
Obs per group: min = 4
               avg = 5.7
               max = 6

Run time (seconds) = 5.234
Integration points = 11
Log Likelihood = -1122.2965

|          | Coef. | Std. Err. | z    | P>|z| | [95% Conf. Interval] |
|----------|-------|-----------|------|-----|----------------------|
| Mean     |       |           |      |     |                      |
| week     | -2.295431 | .1877299 | -12.23 | .000 | -2.663375 to -1.927488 |
| endog    | 1.879423  | 1.076568  | 1.75  | .081 | -.2306119 to 3.989457  |
| endweek  | -.028614  | .2677226  | -0.11 | .915 | -.5533407 to .4961127  |
| _cons    | 22.37832 | .723378   | 30.94 | .000 | 20.96053 to 23.79612   |
From eyeballing the spaghetti plot, we thought we might find:

\[ \beta_0 \approx 25, \beta_1 \approx -3, \beta_2 > 0, \beta_3 \approx?, \alpha_0 \approx?, \alpha_1 > 0, \gamma_0 \approx?, \gamma_1 > 0, \gamma_2 \approx?, \delta_l \approx?, \sigma_v > 0 \]
Model options

• We can remove the group-level linear association between the (log of the) within-group variance and the random-location effects.

```
. runmixregls hamdep week endog endweek, ///
    between(endog) ///
    within(week endog) ///
    association(none)
```

`noconstant` can be used to suppress the constant term (intercept) in each function.

`association(quadratic)` allows for a quadratic association
Random effects/Residuals options

- We can retrieve the standardized random effects and residuals from MIXREGLS and place them in new variables

```
. runmixregrs hamdep week endog endweek, ///
   between(endog) ///
   within(week endog) ///
   association(none) ///
   reffects(theta1 theta2) ///
   residuals(estd)
```
Integration and maximization options

- We can change the maximum number of iterations. The default is `iterate(200)`. This may be useful for simulation studies.

```
. runmixregls hamdep week endog endweek, ///
   between(endog) ///
   within(week endog) ///
   association(none) ///
   reffects(thetal theta2) ///
   residuals(estd) ///
   iterate(100)
```

`noadapt` prevents MIXREGLS from using adaptive Gaussian quadrature. MIXREGLS will use ordinary Gaussian quadrature instead.

`intpoints(#)` sets the number of integration points for (adaptive) Gaussian quadrature. The default is `intpoints(11)`. 
MIXREGLS model files and Reporting options

• We can suppress the table header

`. runmixregrls hamdep week endog endweek, ///
    between(endog) ///
    within(week endog) ///
    association(none) ///
    reffects(theta1 theta2) ///
    residuals(estd)
    iterate(100) ///
    noheader`

typedeffile displays the MIXREGLS model definition file in the results window

typeoutfile displays the MIXREGLS model output file in the results window
estimates store ex1m1

runmixregls hamdep week endog endweek, between(endog) within(week endog) ///
> association(none) reffects(theta1 theta2) residuals(estd) ///
> iterate(100) noheader

|        | Coef.    | Std. Err. | z      | P>|z|  | [95% Conf. Interval] |
|--------|----------|-----------|--------|-----|----------------------|
| Mean   |          |           |        |     |                      |
| week   | -2.243917| .1823754  | -12.30 | 0.000 | -2.601366 -1.886467  |
| endog  | 1.855534 | 1.090148  | 1.70   | 0.089 | -.281116 3.992185   |
| endweek| -0.014723| .2706276  | -0.05  | 0.957 | -.5451477 .515693   |
| _cons  | 22.2052  | .7181727  | 30.92  | 0.000 | 20.79761 23.6128    |
|        |          |           |        |     |                      |
| Between|          |           |        |     |                      |
| endog  | .508993  | .4511428  | 1.13   | 0.259 | -.3752306 1.393217   |
| _cons  | 2.213972 | .3453482  | 6.41   | 0.000 | 1.537102 2.890842   |
|        |          |           |        |     |                      |
| Within |          |           |        |     |                      |
| week   | .1849173 | .0629603  | 2.94   | 0.003 | .0615174 .3083172   |
| endog  | .3026052 | .2461668  | 1.23   | 0.219 | -.1798729 .7850833  |
| _cons  | 2.093735 | .2371797  | 8.83   | 0.000 | 1.628871 2.558598   |
|        |          |           |        |     |                      |
| Scale  |          |           |        |     |                      |
| sigma  | .6983074 | .1277537  | 5.47   | 0.000 | .4479148 .9487      |

LR test of scale sigma=0: chibar2(01) = 22.29 Prob>=chibar2 = 0.0000

estimates store ex1m2
. estimates store ex1m1

. runmixregs hamdep week endog endweek, between(endog) within(week endog) ///
> association(none) reffacts(theta1 theta2) residuals(estd) ///
> iterate(100) noheader

|        | Coef.   | Std. Err. | z      | P>|z|   | [95% Conf. Interval] |
|--------|---------|-----------|--------|-------|----------------------|
| Mean   |         |           |        |       |                      |
| week   | -2.243917 | 0.1823754 | -12.30 | 0.000 | -2.601366            |
|        |         |           |        |       | -1.886467            |
| endog  | 1.855534 | 1.090148  | 1.70   | 0.089 | -0.281116            |
|        |         |           |        |       | 3.992185             |
| endweek| -0.014723 | 0.2706276 | -0.05  | 0.957 | -0.5451477           |
|        |         |           |        |       | 0.515693             |
| _cons  | 22.2052  | 0.7181727 | 30.92  | 0.000 | 20.79761             |
|        |         |           |        |       | 23.6128              |
|        |         |           |        |       |                      |
| Between|         |           |        |       |                      |
| endog  | 0.508993 | 0.4511428 | 1.13   | 0.259 | -0.3752306           |
|        |         |           |        |       | 1.393217             |
| _cons  | 2.213972 | 0.3453482 | 6.41   | 0.000 | 1.537102             |
|        |         |           |        |       | 2.890842             |
|        |         |           |        |       |                      |
| Within |         |           |        |       |                      |
| week   | 0.1849173 | 0.0629603 | 2.94   | 0.003 | 0.0615174            |
|        |         |           |        |       | 0.3083172            |
| endog  | 0.3026052 | 0.2461668 | 1.23   | 0.219 | -0.1798729           |
|        |         |           |        |       | 0.7850833            |
| _cons  | 2.093735 | 0.2371797 | 8.83   | 0.000 | 1.628871             |
|        |         |           |        |       | 2.558598             |
|        |         |           |        |       |                      |
| Scale  |         |           |        |       |                      |
| sigma  | 0.6983074 | 0.1277537 | 5.47   | 0.000 | 0.4479148            |
|        |         |           |        |       | 0.9487               |

LR test of scale sigma=0: chibar2(01) = 22.29 Prob>=chibar2 = 0.0000

. estimates store ex1m2
Standardized random effects and residual errors

- scatter theta2 theta1
- histogram estd, width(0.5) start(-3) frequency
estimates store ex1m1

runmiregls hamdep week endog endweek, between(endog) within(week endog) ///
> association(none) reffects(theta1 theta2) residuals(estd) ///
> iterate(100) noheader

|          | Coef. | Std. Err. | z     | P>|z|   | [95% Conf. Interval] |
|----------|-------|-----------|-------|-------|----------------------|
| Mean     |       |           |       |       |                      |
| week     | -2.243917 | .1823754  | -12.30 | 0.000 | -2.601366 to -1.886467 |
| endog    | 1.855534 | 1.090148  | 1.70   | 0.089 | -.281116 to 3.992185  |
| endweek  | -.0147273 | .2706276  | -0.05  | 0.957 | -.5451477 to .515693  |
| _cons    | 22.2052 | .7181727  | 30.92  | 0.000 | 20.79761 to 23.6128   |
| Between  |       |           |       |       |                      |
| endog    | .508993 | .4511428  | 1.13   | 0.259 | -.3752306 to 1.393217 |
| _cons    | 2.213972 | .3453482  | 6.41   | 0.000 | 1.537102 to 2.890842  |
| Within   |       |           |       |       |                      |
| week     | .1849173 | .0629603  | 2.94   | 0.003 | .0615174 to .3083172  |
| endog    | .3026052 | .2461668  | 1.23   | 0.219 | -.1798729 to .7850833 |
| _cons    | 2.093735 | .2371797  | 8.83   | 0.000 | 1.628871 to 2.558598  |
| Scale    |       |           |       |       |                      |
| sigma    | .6983074 | .1277537  | 5.47   | 0.000 | .4479148 to .9487     |

LR test of scale sigma=0: chibar2(01) = 22.29 Prob>=chibar2 = 0.0000

estimates store ex1m2
. lrtest ex1m1 ex1m2

Likelihood-ratio test
(Assumption: ex1m2 nested in ex1m1)

. test endog endweek

( 1) [Mean]endog = 0
( 2) [Between]endog = 0
( 3) [Within]endog = 0
( 4) [Mean]endweek = 0

      chi2(  4) =  6.58
  Prob > chi2 = 0.1597

. nlcom (sigma2_v: [Scale]sigma^2)

    sigma2_v: [Scale]sigma^2

|        | Coef. | Std. Err. |      z  |    P>|z| |      95% Conf. Interval |
|--------|-------|-----------|---------|--------|------------------------|
| hamdep |       |           |         |        |                        |
| sigma2_v | .4876332 | .1784227 |  2.73  | 0.006  | .1379312               | .8373352 |
HELP FILE
Title

runmixregls - Run the MIXREGLS mixed-effects location scale software from within Stata

Syntax

    runmixregls depvar [varlist] [if] [in] [, options]

where varlist specifies variables in the mean function.

options

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>noconstant</td>
<td>suppress constant term in the mean function</td>
</tr>
<tr>
<td>_between(varlist[, noconstant])</td>
<td>specify variables in between-group variance function</td>
</tr>
<tr>
<td>_within(varlist[, noconstant])</td>
<td>specify variables in within-group variance function</td>
</tr>
<tr>
<td>_association(atype)</td>
<td>specify the group-level association between the (log of the) within-group variance and the random-location effects</td>
</tr>
</tbody>
</table>

Random effects/Residuals

reffects(varname1 varname2) retrieve standardized random-location and random-scale effects
residuals(varname) retrieve standardized residual errors

Integration

noadapt do not perform adaptive Gaussian quadrature
Remarks

Remarks are presented under the following headings:

Remarks on the mixed-effects location scale model
Remarks on getting runmixregls working for the first time
Remarks on how runmixregls works
Remarks on MIXREGLS estimation
Remarks on runmixregls output

Remarks on the mixed-effects location scale model

The mixed-effects location scale model fitted by MIXREGLS consists of three functions

1. the mean function,
2. the between-group variance function,
3. the within-group variance function.

These three functions can be written as

\[ y_{ij} = b_1 x_{1ij} + \sigma_{u_{ij}} \theta_{1j} + e_{ij}, \quad i=1, \ldots, n_j; \quad j=1, \ldots, J, \]
\[ \log(\sigma_{2u_{ij}}) = b_2 x_{2ij}, \]
\[ \log(\sigma_{2e_{ij}}) = b_3 x_{3ij} + a_1 \theta_{1j} + a_2 \theta_{1j}^2 + \sigma_v \theta_{2j}, \]

where
Example: Replicate Hederke and Nordgren 2013 (pages 10-18)

The following example will only work once you have installed MIXREGLS and once you have declared the file address for the MIXREGLS executable. See Remarks on getting runmixregls working for the first time.

Load the data
   . use http://www.bristol.ac.uk/cmm/media/runmixregls/riesby, clear

Recode missing values in hamdep from -9 to Stata system missing
   . recode hamdep (-9=.)

Declare panel variable to be id
   . xtset id

Fit the mixed-effects location scale model
   . runmixregls hamdep week endog endweek, between(endog) within(week endog)

Refit the model, this time retrieving the BLUPs of the standardized random-location and random-scale effects, and their associated standard errors
   . runmixregls hamdep week endog endweek, between(endog) within(week endog) reffects(theta1 theta2)

Examine a scatter plot of the BLUPs of the standardized random-scale effects against the standardized random-location effects
   . scatter theta2 theta1

Refit the model removing the group-level linear association between the (log of the) within-group variance and the intercept
   . runmixregls hamdep week endog endweek, between(endog) within(week endog)
REFERENCES
References
