Running MIXREGLS from within Stata: the `runmixregls` command

CMM Research Group
Bristol
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George Leckie
Centre for Multilevel Modelling
University of Bristol

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

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

$$u_j \sim \mathrm{N}(0, \sigma_u^2)$$

$$e_{ij} \sim \mathrm{N}(0, \sigma_e^2)$$

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** σ_u^2
- e_{ij} is the residual-error with **within-group variance** σ_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 $\log(\sigma_e^2) = \gamma_0$

$\theta_{1j} \sim \mathrm{N}(0,1)$

$e_{ij} \sim \mathrm{N}(0, \sigma_e^2)$

where

- σ_u is the square root of the between-group variance
- θ_{1j} is the standardised group random-intercept effect
- α_0 is the log of the between-group variance
- γ_0 is the log of the within-group variance
- σ_u, σ_u^2 and σ_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 $$y_{ij} = \beta_0 + \beta_1 x_{ij} + \beta_2 w_j + \sigma_{u_{ij}} \theta_{1j} + e_{ij}$$

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

Within $$\log\left(\sigma^2_{e_{ij}}\right) = \gamma_0 + \gamma_1 x_{ij} + \gamma_2 w_j$$

$$\theta_{1j} \sim \mathrm{N}(0,1)$$

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

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

$$\theta_{1j} \sim \mathrm{N}(0,1)$$

$$\theta_{2j} \sim \mathrm{N}(0,1)$$

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

- We now refer to θ_{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

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 $$\log\left(\sigma^2_{e_{ij}}\right) = \gamma_0 + \gamma_1 x_{ij} + \gamma_2 w_j + \delta_l \theta_{1j} + \delta_q \theta^2_{1j} + \sigma_v \theta_{2j}$$

$$\theta_{1j} \sim \mathrm{N}(0,1)$$

$$\theta_{2j} \sim \mathrm{N}(0,1)$$

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

- 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
  - https://hedeker-sites.uchicago.edu/sites/hedeker.uchicago.edu/files/uploads/MixregLS_RevisedSept2013.zip
- `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
```

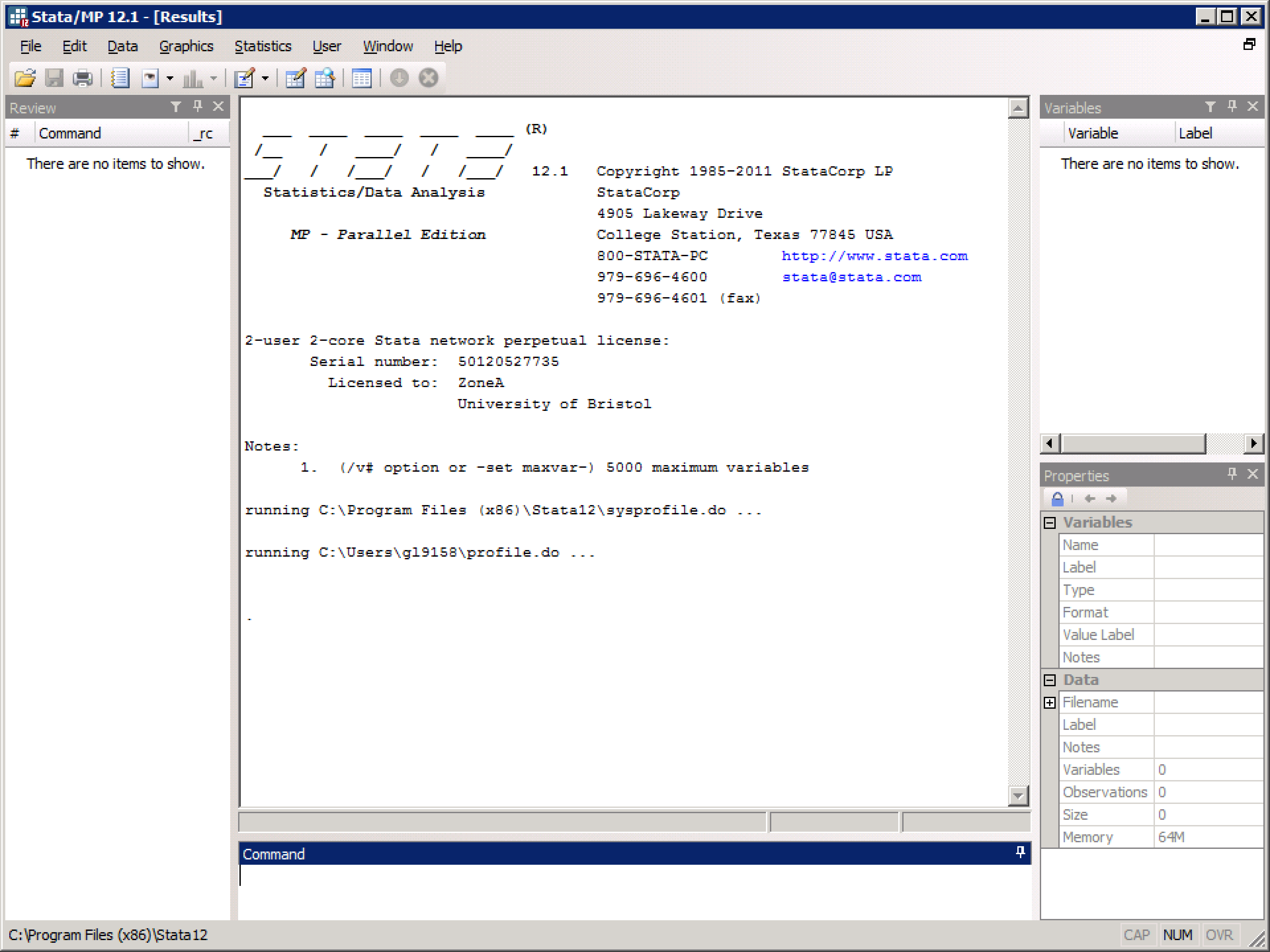
- Next, you must declare the fully qualified path and filename for the **MIXREGLS** executable (the **MIXREGLS** .exe file) so that `runmixregls` knows where to find the software. You can do this by specifying a `global` macro called `mixreglspath`. For example

```
. global mixreglspath "C:\MIXREGLS\mixreglsb.exe"
```

EXAMPLE:
REISBY DEPRESSION DATA

Reisby depression data

- Hedeker and Nordgren (2013) analyse data drawn from a six-week longitudinal psychiatric study of 66 depressed inpatients (Reisby et al., 1977).
- 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**)


Stata/MP 12.1 - [Results]
File Edit Data Graphics Statistics User Window Help
Review
Command _rc
There are no items to show.
(R)
12.1 Copyright 1985-2011 StataCorp LP
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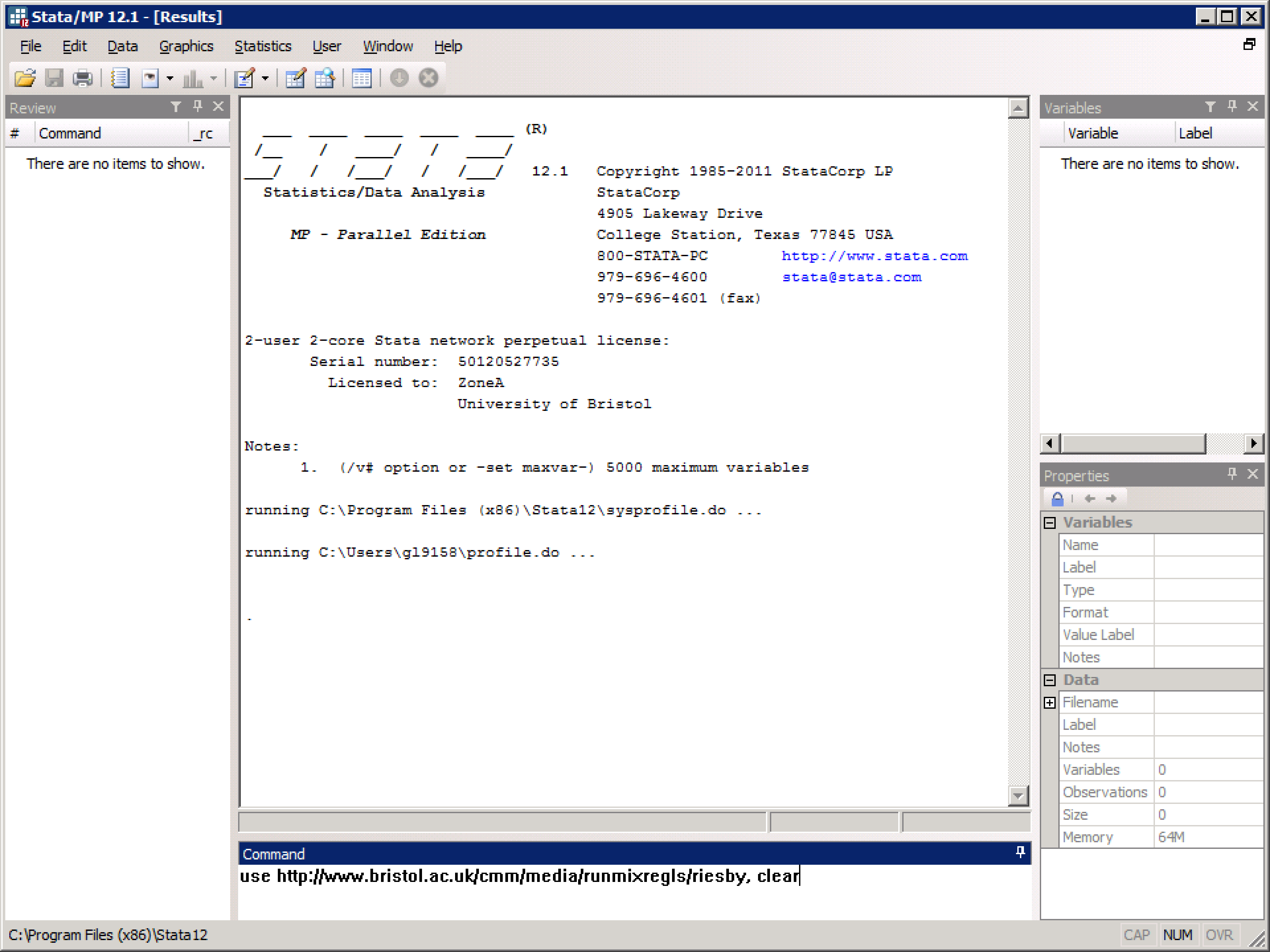
979-696-4601 (fax)
2-user 2-core Stata network perpetual license:
Serial number: 50120527735
Licensed to: ZoneA
University of Bristol
Notes:
1. (/v# option or -set maxvar-) 5000 maximum variables
running C:\Program Files (x86)\Stata12\sysprofile.do ...
running C:\Users\gl9158\profile.do ...
Command
Variables
Variable Label
There are no items to show.
Properties
Variables
Name
Label
Type
Format
Value Label
Notes
Data
Filename
Label
Notes
Variables 0
Observations 0
Size 0
Memory 64M
C:\Program Files (x86)\Stata12
CAP NUM OVR


Stata/MP 12.1 - [Results]
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Review
Command _rc
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Notes:
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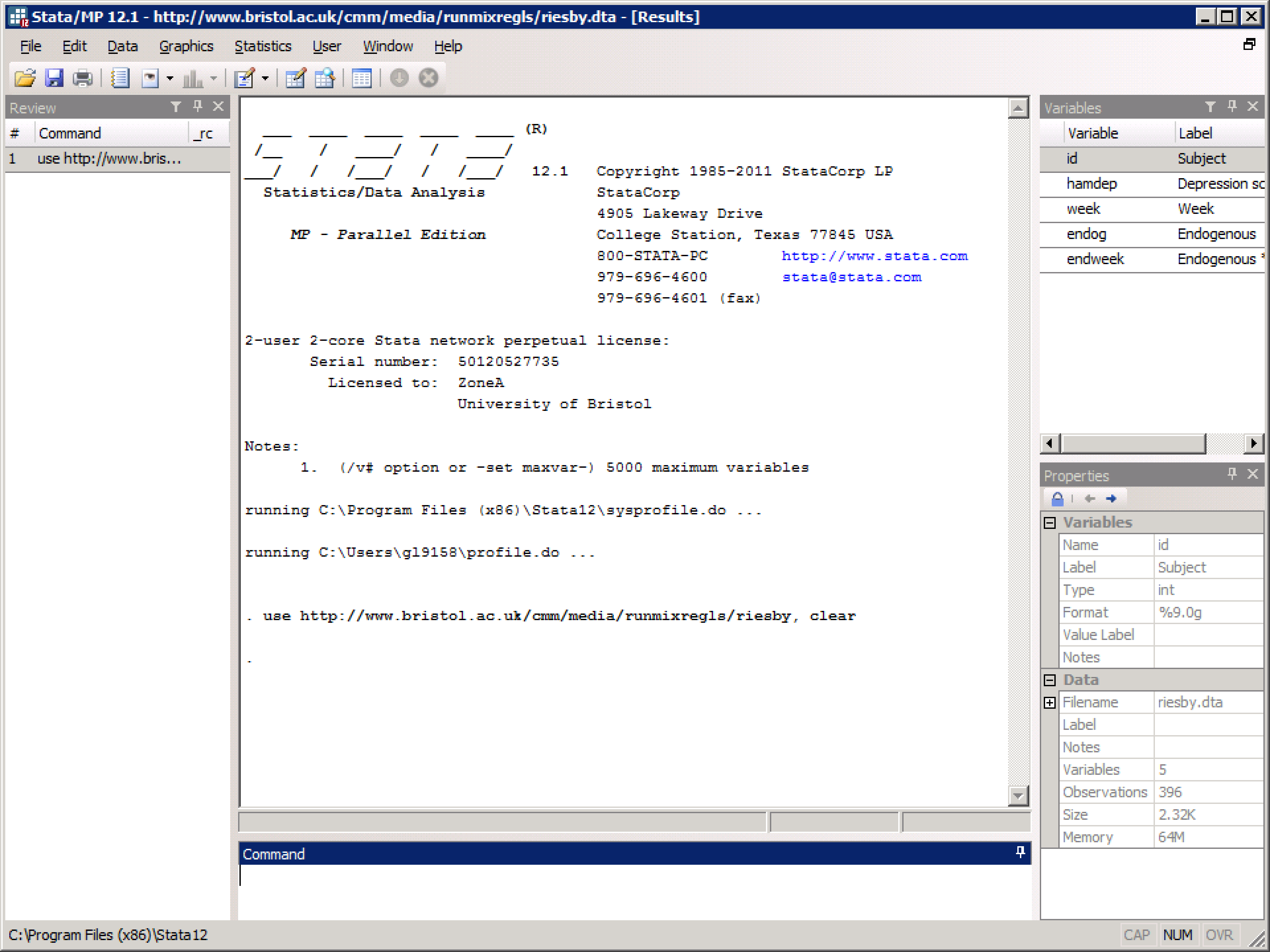
running C:\Users\gl9158\profile.do ...
Variables
Variable Label
There are no items to show.
Properties
Variables
Name
Label
Type
Format
Value Label
Notes
Data
Filename
Label
Notes
Variables 0
Observations 0
Size 0
Memory 64M
Command
use http://www.bristol.ac.uk/cmm/media/runmixregls/riesby, clear
C:\Program Files (x86)\Stata12
CAP NUM OVR


Stata/MP 12.1 - http://www.bristol.ac.uk/cmm/media/runmixregls/riesby.dta - [Results]
File Edit Data Graphics Statistics User Window Help
Review
Command _rc
1 use http://www.bris...
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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
.
Command
Variables
Variable Label
id Subject
hamdep Depression sc
week Week
endog Endogenous
endweek Endogenous
Properties
Variables
Name id
Label Subject
Type int
Format %9.0g
Value Label
Notes
Data
Filename riesby.dta
Label
Notes
Variables 5
Observations 396
Size 2.32K
Memory 64M
C:\Program Files (x86)\Stata12
CAP NUM OVR

Stata/MP 12.1 - http://www.bristol.ac.uk/cmm/media/runmixregls/riesby.dta - [Results]

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```
  ___  ____  ____  ____  ____ (R)
 /__    /   ____/   /   ____/
___/   /   /___/   /   /___/   12.1   Copyright 1985-2011 StataCorp LP
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                                      979-696-4601 (fax)

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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

.
```
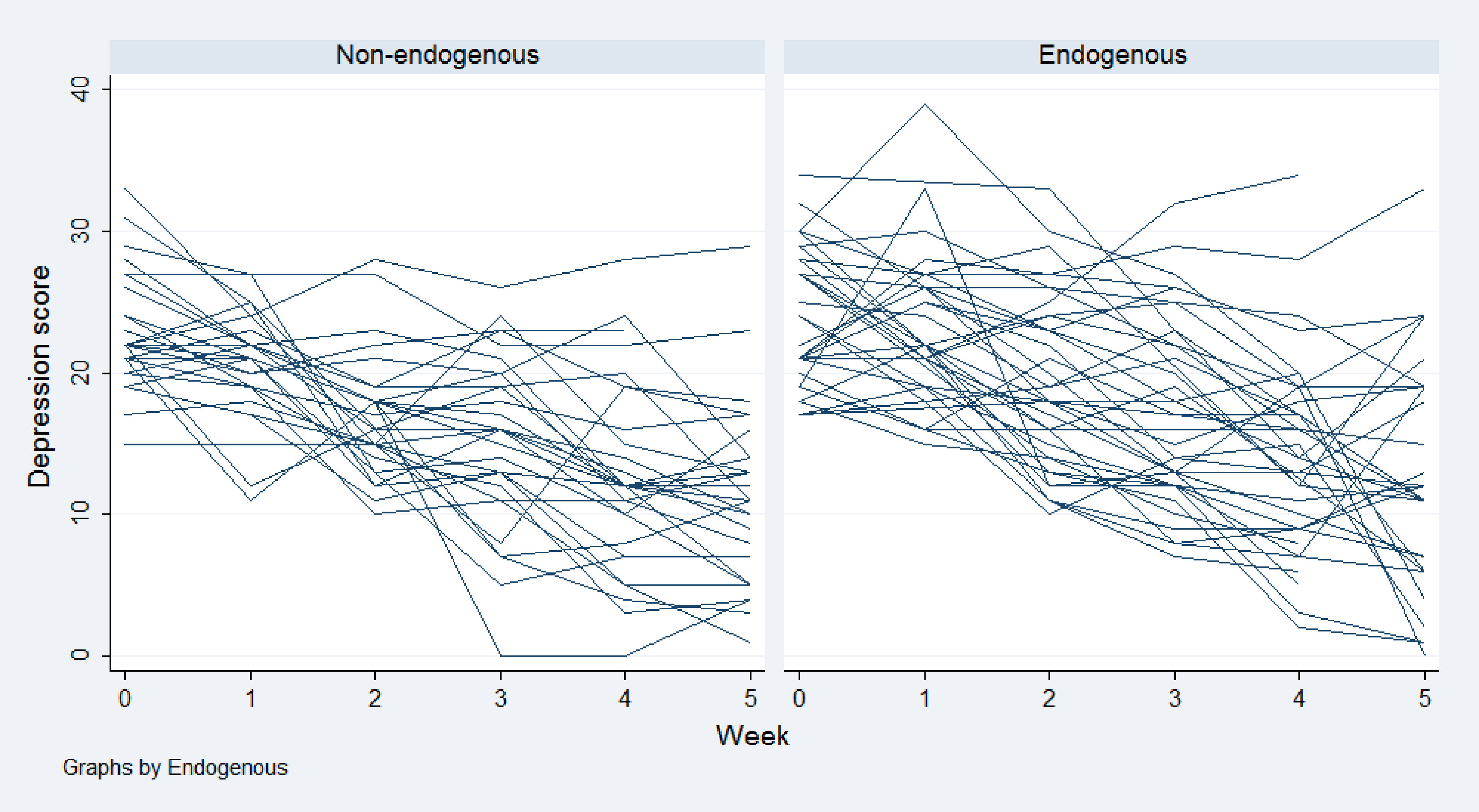

Variable
id
hamdep
week
endog
endweek

C:\Program Files (x86)\Stata12

CAP NUM OVR

Spaghetti plot, by depression group




```
. 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

$$\mathbf{hamdep}_{ij} = \beta_0 + \beta_1 \mathbf{week}_{ij} + \beta_2 \mathbf{endog}_j + \beta_2 \mathbf{endweek}_{\boldsymbol{ij}} + \sigma_{u_j}\theta_{1j} + e_{ij}$$

$$\log\left(\sigma^2_{u_j}\right) = \alpha_0 + \alpha_1 \mathbf{endog}_j$$

$$\log\left(\sigma^2_{e_{ij}}\right) = \gamma_0 + \gamma_1 \mathbf{week}_{ij} + \gamma_2 \mathbf{endog}_j + \delta_l \theta_{1j} + \sigma_v \theta_{2j}$$

$$\theta_{1j} \sim \mathrm{N}(0,1)$$

$$\theta_{2j} \sim \mathrm{N}(0,1)$$

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

- 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

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

$$\log\left(\sigma^2_{u_j}\right) = \alpha_0 + \alpha_1\mathbf{endog}_j$$

$$\log\left(\sigma^2_{e_{ij}}\right) = \gamma_0 + \gamma_1\mathbf{week}_{ij} + \gamma_2\mathbf{endog}_j + \delta_l\theta_{1j} + \sigma_v\theta_{2j}$$

$$\theta_{1j} \sim \mathrm{N}(0,1)$$

$$\theta_{2j} \sim \mathrm{N}(0,1)$$

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

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

Stata/MP 12.1 - http://www.bristol.ac.uk/cmm/media/runmixregls/riesby.dta - [Results]

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```
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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

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

. xtset id
       panel variable:  id (balanced)

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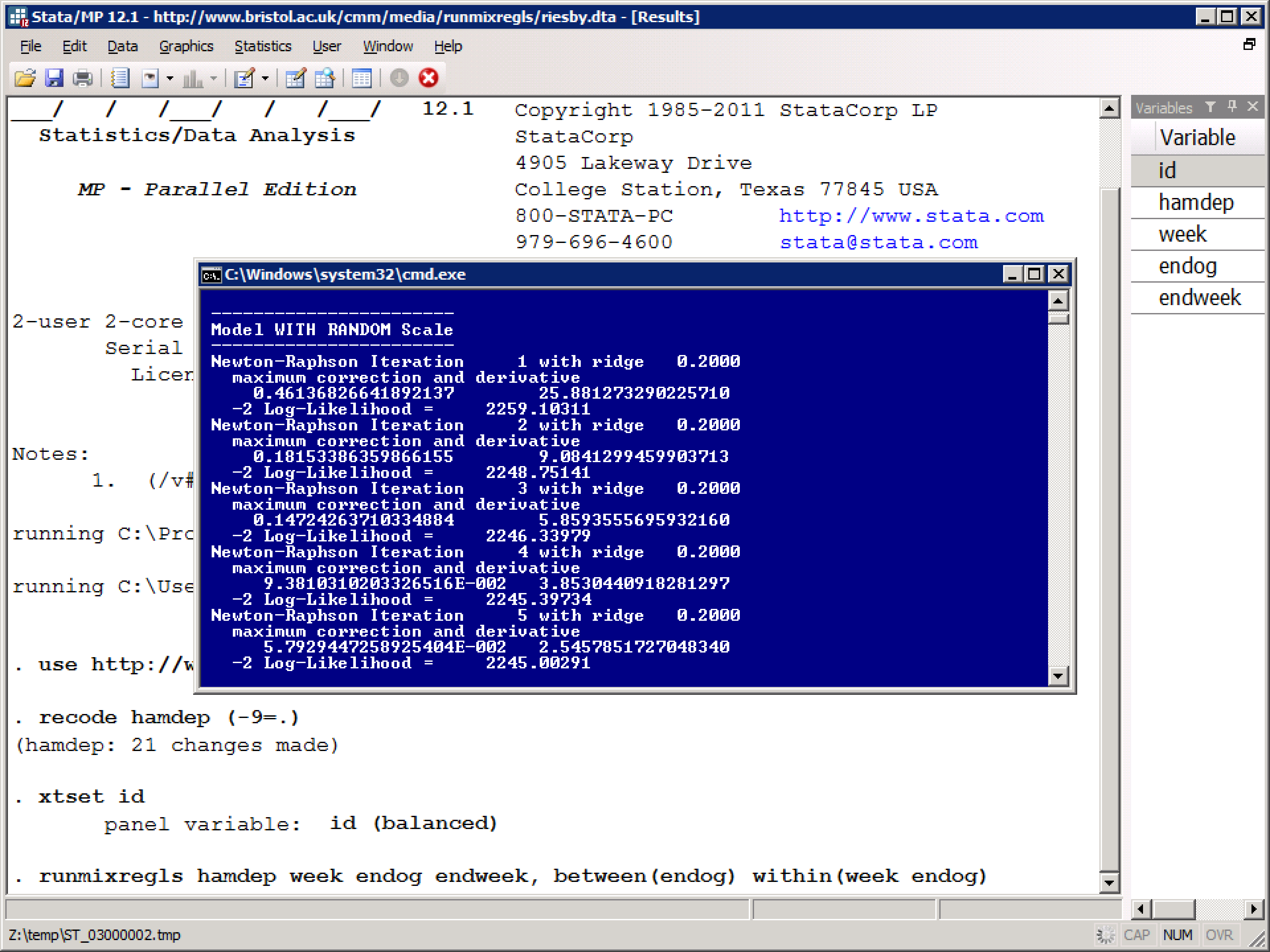

Variables
Variable
id
hamdep
week
endog
endweek

Z:\temp\ST_03000002.tmp

CAP NUM OVR


Stata/MP 12.1 - http://www.bristol.ac.uk/cmm/media/runmixregls/riesby.dta - [Results]
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Serial
Notes:
running C:\Pro
running C:\Use
. use http://w
. recode hamdep (-9=.)
(hamdep: 21 changes made)
. xtset id
panel variable: id (balanced)
. runmixregls hamdep week endog endweek, between(endog) within(week endog)
Z:\temp\ST_03000002.tmp
CAP NUM OVR
Variables
Variable
id
hamdep
week
endog
endweek
C:\Windows\system32\cmd.exe
Model WITH RANDOM Scale
Newton-Raphson Iteration 1 with ridge 0.2000
maximum correction and derivative
0.461368266418921372 25.881273290225710
-2 Log-Likelihood = 2259.10311
Newton-Raphson Iteration 2 with ridge 0.2000
maximum correction and derivative
0.18153386359866155 9.0841299459903713
-2 Log-Likelihood = 2248.75141
Newton-Raphson Iteration 3 with ridge 0.2000
maximum correction and derivative
0.14724263710334884 5.8593555695932160
-2 Log-Likelihood = 2246.33979
Newton-Raphson Iteration 4 with ridge 0.2000
maximum correction and derivative
9.3810310203326516E-002 3.8530440918281297
-2 Log-Likelihood = 2245.39734
Newton-Raphson Iteration 5 with ridge 0.2000
maximum correction and derivative
5.7929447258925404E-002 2.5457851727048340
-2 Log-Likelihood = 2245.00291

Stata/MP 12.1 - http://www.bristol.ac.uk/cmm/media/runmixregls/riesby.dta - [Results]

File Edit Data Graphics Statistics User Window Help

```
. use http://www.bristol.ac.uk/cmm/media/runmixregls/riesby, 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
Group variable: id                               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

------------------------------------------------------------------------------
      hamdep |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Mean         |
        week |  -2.295431   .1877299   -12.23   0.000    -2.663375   -1.927488
       endog |   1.879423   1.076568     1.75   0.081    -.2306119    3.989457
     endweek |   -.028614   .2677226    -0.11   0.915    -.5533407    .4961127
       _cons |   22.37832    .723378    30.94   0.000     20.96053    23.79612
-------------+----------------------------------------------------------------
```

Variables

Variable
id
hamdep
week
endog
endweek

C:\Program Files (x86)\Stata12 CAP NUM OVR

Stata/MP 12.1 - http://www.bristol.ac.uk/cmm/media/runmixregls/riesby.dta - [Results]

hamdep	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Mean						
week	-2.295431	.1877299	-12.23	0.000	-2.663375	-1.927488
endog	1.879423	1.076568	1.75	0.081	-.2306119	3.989457
endweek	-.028614	.2677226	-0.11	0.915	-.5533407	.4961127
_cons	22.37832	.723378	30.94	0.000	20.96053	23.79612
Between						
endog	.5068167	.4581146	1.11	0.269	-.3910714	1.404705
_cons	2.198253	.3544331	6.20	0.000	1.503577	2.892929
Within						
week	.1923404	.0628283	3.06	0.002	.0691991	.3154817
endog	.2881487	.2454437	1.17	0.240	-.1929121	.7692094
_cons	2.087681	.2363751	8.83	0.000	1.624394	2.550968
Association						
linear	.2132653	.1455909	1.46	0.143	-.0720875	.4986182
Scale						
sigma	.6586948	.1339515	4.92	0.000	.3961547	.9212349

LR test of scale sigma=0: chibar2(01) = 24.41 Prob>=chibar2 = 0.0000

From eyeballing the spaghetti plot, we thought we might find:

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

Variables: Variable, id, hamdep, week, endog, endweek

C:\Program Files (x86)\Stata12

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

```
. runmixregls 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(theta1 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

```
. runmixregls 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

Stata/MP 12.1 - http://www.bristol.ac.uk/cmm/media/runmixregls/riesby.dta - [Results]

File Edit Data Graphics Statistics User Window Help

```
. estimates store ex1m1

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

------------------------------------------------------------------------------
      hamdep |      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 |  -.0147273   .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
```

Variables

- Variable
- id
- hamdep
- week
- endog
- endweek
- _est_ex1...
- theta1
- theta2
- theta1_se
- theta2_se
- estd
- _est_ex1...

C:\Program Files (x86)\Stata12 CAP NUM OVR

Stata/MP 12.1 - http://www.bristol.ac.uk/cmm/media/runmixregls/riesby.dta - [Results]

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```
. estimates store ex1m1

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

------------------------------------------------------------------------------
      hamdep |      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 |  -.0147273   .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
```

Variables

Variable
id
hamdep
week
endog
endweek
_est_ex1...
theta1
theta2
theta1_se
theta2_se
estd
_est_ex1...

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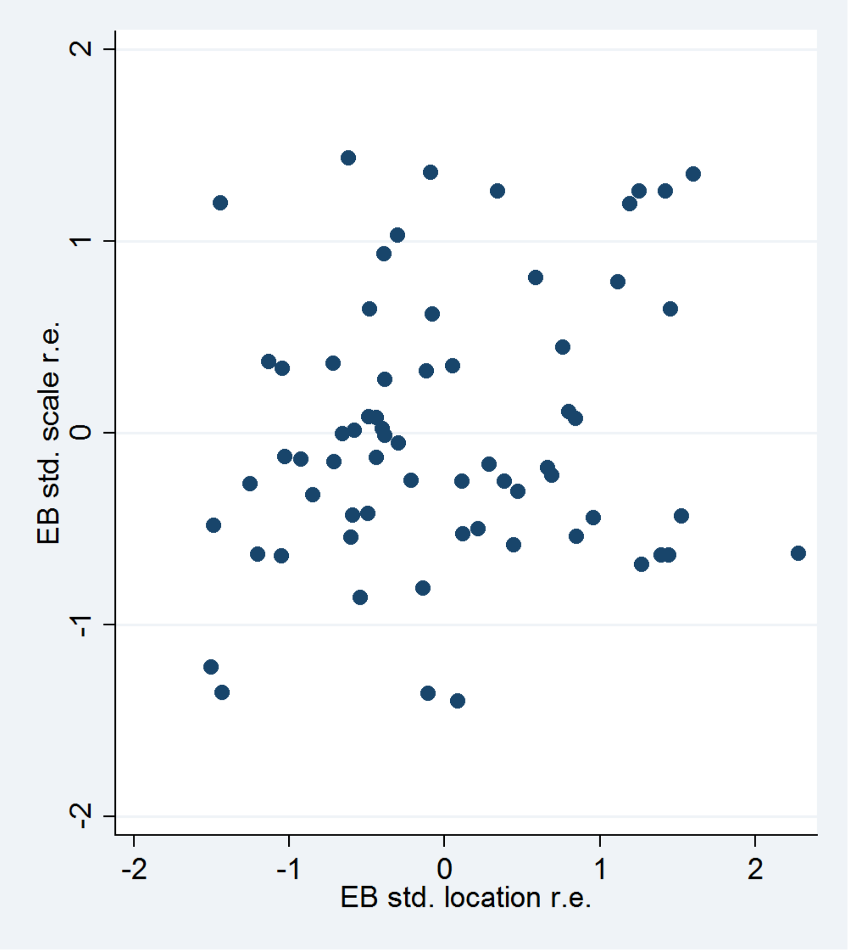
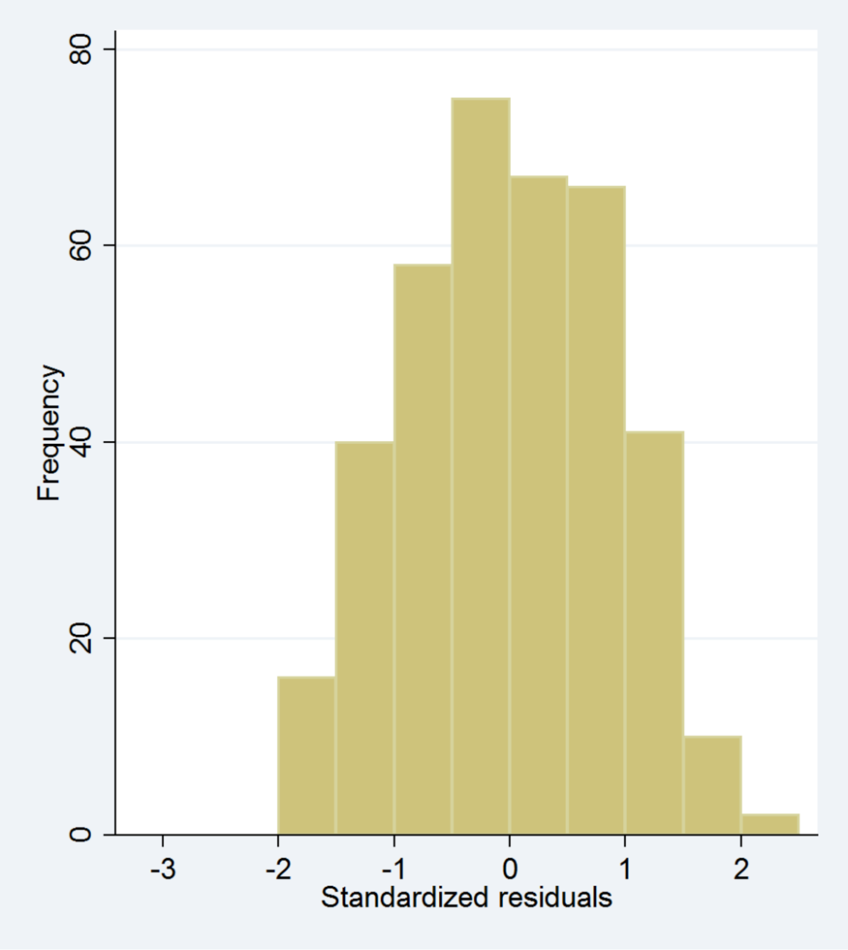
Standardized random effects and residual errors






```
. scatter theta2 theta1
. histogram estd, width(0.5) start(-3) frequency
```

Stata/MP 12.1 - http://www.bristol.ac.uk/cmm/media/runmixregls/riesby.dta - [Results]

File Edit Data Graphics Statistics User Window Help

```
. estimates store ex1m1

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

------------------------------------------------------------------------------
      hamdep |      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 |  -.0147273   .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
```

Variables
Variable
id
hamdep
week
endog
endweek
_est_ex1...
theta1
theta2
theta1_se
theta2_se
estd
_est_ex1...

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Stata/MP 12.1 - http://www.bristol.ac.uk/cmm/media/runmixregls/riesby.dta - [Results]

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```
. lrtest ex1m1 ex1m2

Likelihood-ratio test                                 LR chi2(1)  =      2.11
(Assumption: ex1m2 nested in ex1m1)                   Prob > chi2 =    0.1461

.
.
. 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
```

hamdep	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
sigma2_v	.4876332	.1784227	2.73	0.006	.1379312	.8373352

Variable
id
hamdep
week
endog
endweek
_est_ex1...
theta1
theta2
theta1_se
theta2_se
estd
_est_ex1...

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HELP FILE

Viewer - help runmixregls

File Edit History Help

help runmixregls

help runmixregls

Dialog | Also See | Jump To

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	Description
Model	
noconstant	suppress constant term in the mean function
between(*varlist*[, **noconstant**])	specify variables in between-group variance function
within(*varlist*[, **noconstant**])	specify variables in within-group variance function
association(*atype*)	specify the group-level association between the (log of the) within-group variance and the random-location effects
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

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Viewer - help runmixregls

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help runmixregls##remarks

help runmixregls

Dialog Also See Jump To

Remarks

Remarks are presented under the following headings:

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*x1_ij + sigma_u_ij*theta1_j + e_ij,   i=1,...,n_j;   j=1,...,J,

log(sigma2_u_ij) = b_2*x2_ij,

log(sigma2_e_ij) = b_3*x3_ij + a_l*theta1_j + a_q*theta1_j^2 + sigma_v*theta2_j,
```

where

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Viewer - help runmixregls

help runmixregls##examples

Example: Replicate Hedeker 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)
```

Ready

REFERENCES

References

- Leckie, G. (2014). runmixregls - A Program to Run the MIXREGLS Mixed-effects Location Scale Software from within Stata. *Journal of Statistical Software*, 59, Code Snippet 2, 1-41. URL: https://www.jstatsoft.org/article/view/v059c02.

- Hedeker, D, Nordgren, R (2013). MIXREGLS: A Program for Mixed-effects Location Scale Analysis. Journal of Statistical Software, 52, 12, 1-38. URL: http://www.jstatsoft.org/v52/i12.