Running MLwiN from within Stata: the runmlwin command

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Running MLwiN from within Stata: the `runmlwin` command

George Leckie and Chris Charlton
Centre for Multilevel Modelling
University of Bristol

Existing multilevel modelling commands in Stata

- Stata provide the `xtmixed`, `xtmelogit` and `xtmepoisson` commands
  - Limited range of models can be specified
  - Computationally quite slow to fit models

- Sophia Rabe-Hesketh (with Anders Skrondal) provide the `gllamm` command
  - Very wide range of models can be specified
  - Computationally slow to fit most models

Multilevel modelling in MLwiN

1. Estimation of multilevel models for continuous, binary, ordered categorical, unordered categorical and count data

2. Fast estimation via classical and Bayesian methods

3. Estimation of multilevel models for cross-classified and multiple membership non-hierarchical data structures

4. Estimation of multilevel multivariate response models, multilevel spatial models, multilevel measurement error models, multilevel multiple imputation models and multilevel factor models

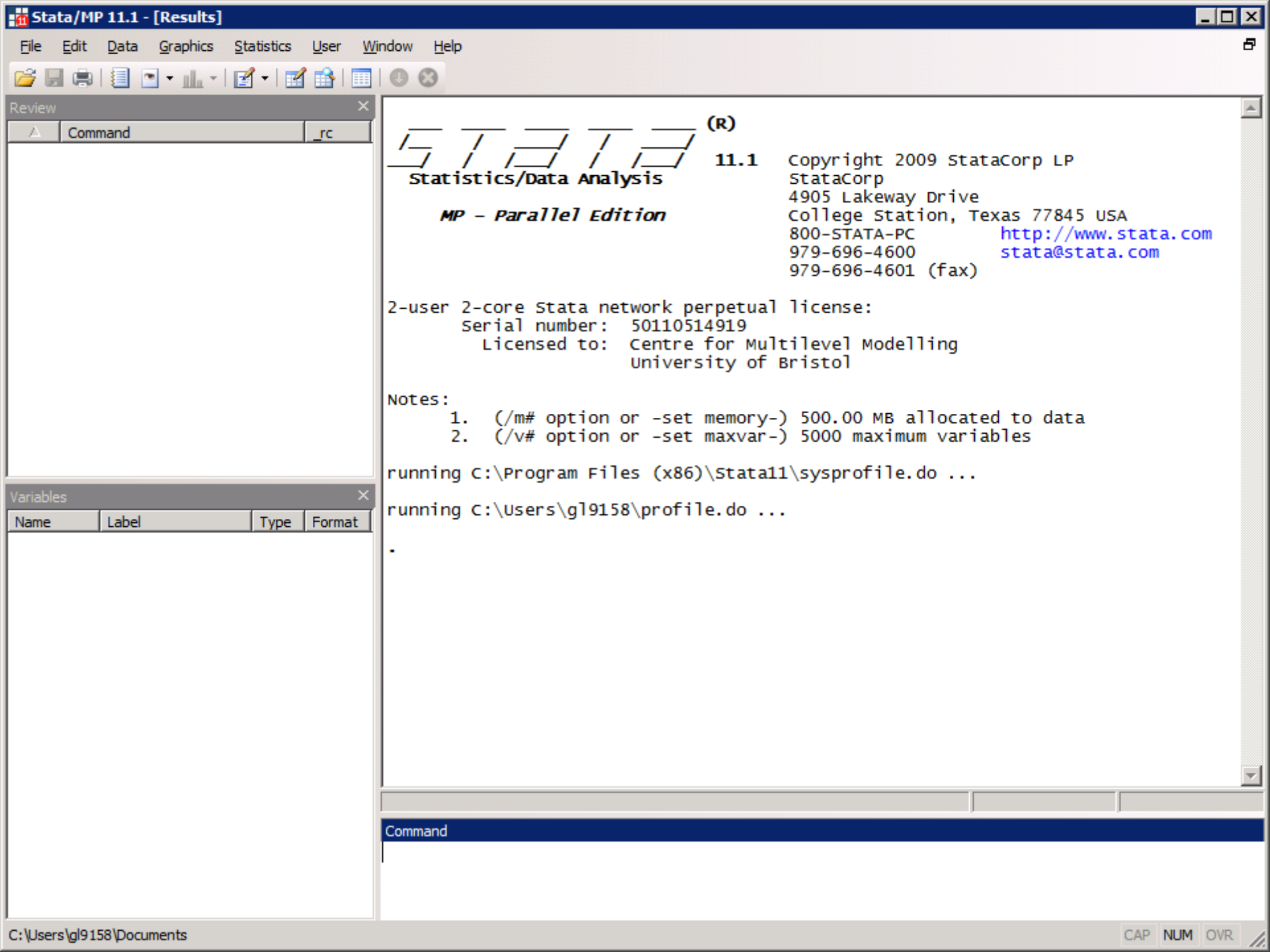
Two-level variance components model

- Classic MLwiN User Manual example
- 4059 students nested within 65 schools

$$normexam_{ij} = \beta_0 + u_j + e_{ij}$$

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

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


Stata/MP 11.1 - [Results]
File Edit Data Graphics Statistics User Window Help
Review
Command _rc
Variables
Name Label Type Format
(R)
Statistics/Data Analysis
11.1
MP – Parallel Edition
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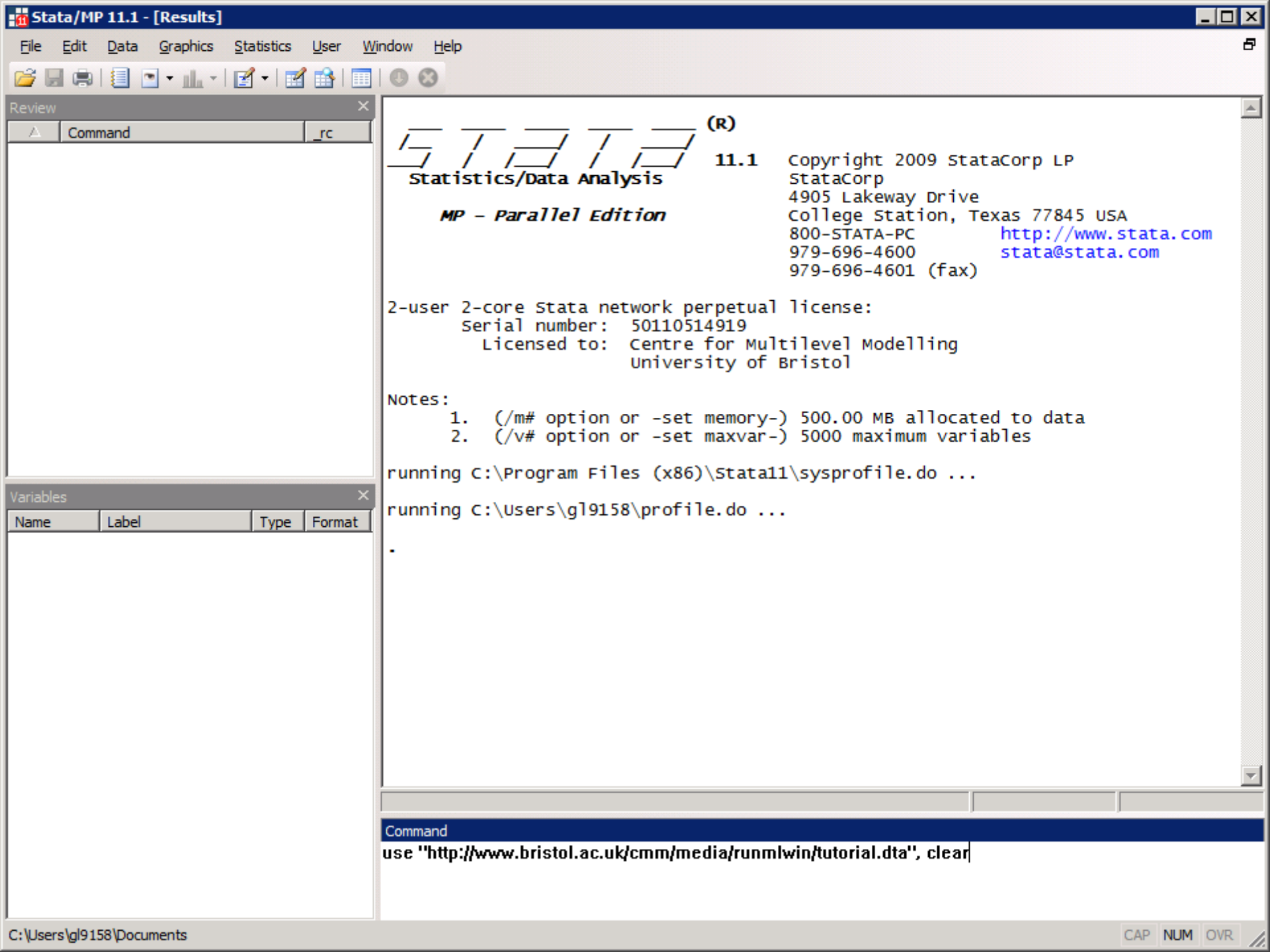
University of Bristol
Notes:
1. (/m# option or -set memory-) 500.00 MB allocated to data
2. (/v# option or -set maxvar-) 5000 maximum variables
running C:\Program Files (x86)\Stata11\sysprofile.do ...
running C:\Users\gl9158\profile.do ...
.
Command
C:\Users\gl9158\Documents
CAP NUM OVR


Stata/MP 11.1 - [Results]
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.
Command
use "http://www.bristol.ac.uk/cmm/media/runmlwin/tutorial.dta", clear
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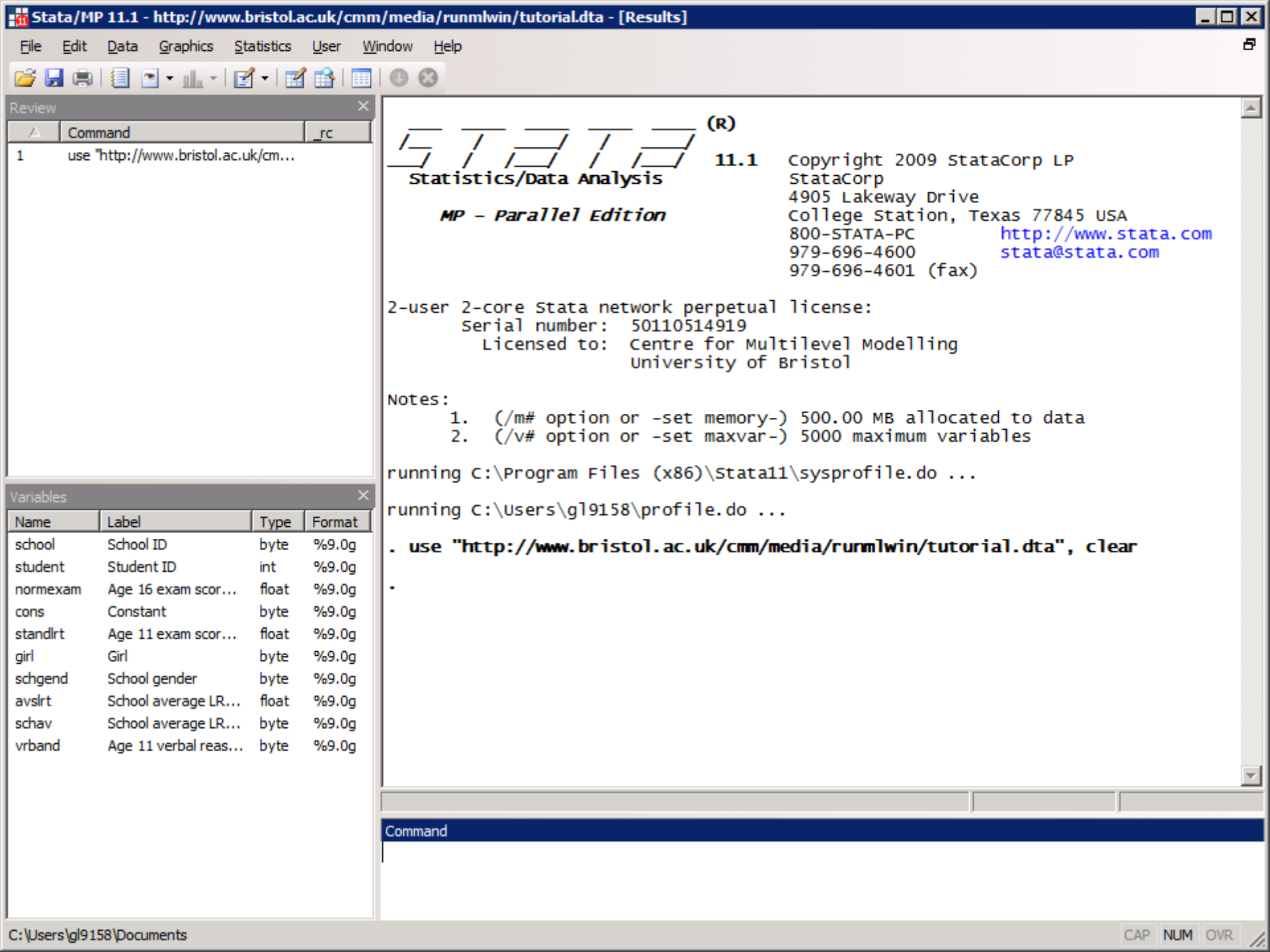
Stata/MP 11.1 - http://www.bristol.ac.uk/cmm/media/runmlwin/tutorial.dta - [Results]
File Edit Data Graphics Statistics User Window Help
Review
Command _rc
1 use "http://www.bristol.ac.uk/cm...
Variables
Name Label Type Format
school School ID byte %9.0g
student Student ID int %9.0g
normexam Age 16 exam scor... float %9.0g
cons Constant byte %9.0g
standlrt Age 11 exam scor... float %9.0g
girl Girl byte %9.0g
schgend School gender byte %9.0g
avslrt School average LR... float %9.0g
schav School average LR... byte %9.0g
vrband Age 11 verbal reas... byte %9.0g
(R)
11.1
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MP - Parallel Edition
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running C:\Users\gl9158\profile.do ...
. use "http://www.bristol.ac.uk/cmm/media/runmlwin/tutorial.dta", clear
.
Command
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The `runmlwin` command syntax

$$normexam_{ij} = \beta_0 + u_j + e_{ij}$$

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

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

```
. runmlwin normexam cons, ///
      level2(school: cons) ///
      level1(student: cons)
```

Stata/MP 11.1 - http://www.bristol.ac.uk/cmm/media/runmlwin/tutorial.dta - [Results]

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Review

	Command	_rc
1	use "http://www.bristol.ac.uk/cm...	

Variables

Name	Label	Type	Format
school	School ID	byte	%9.0g
student	Student ID	int	%9.0g
normexam	Age 16 exam scor...	float	%9.0g
cons	Constant	byte	%9.0g
standlrt	Age 11 exam scor...	float	%9.0g
girl	Girl	byte	%9.0g
schgend	School gender	byte	%9.0g
avslrt	School average LR...	float	%9.0g
schav	School average LR...	byte	%9.0g
vrband	Age 11 verbal reas...	byte	%9.0g

```
                                                (R)
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Notes:
      1.  (/m# option or -set memory-) 500.00 MB allocated to data
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running C:\Program Files (x86)\Stata11\sysprofile.do ...

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

. use "http://www.bristol.ac.uk/cmm/media/runmlwin/tutorial.dta", clear

.
```

Command

```
runmlwin normexam cons, level2(school: cons) level1(student: cons)
```

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Stata/MP 11.1 - http://www.bristol.ac.uk/cmm/media/runmlwin/tutorial.dta - [Results]

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Review

	Command	_rc
1	use "http://www.bristol.ac.uk/cm...	
2	runmlwin normexam cons, level2(...	

Variables

Name	Label
school	School ID
student	Student ID
normexam	Age 16 exam sc
cons	Constant
standlrt	Age 11 exam sc
girl	Girl
schgend	School gender
avslrt	School average
schav	School average
vrband	Age 11 verbal re

```
  ___  ____  ____  ____  ____ (R)
 /__    /   ____/   /   ____/
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       Serial number:  50110514919
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                       University of Bristol

Notes:
      1.  (/m# option or -set memory-) 500.00 MB allocated to data
                                                                  es
```

MLwiN

Version 2.23

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University of Bristol

Software authors :
Jon Rasbash
and
William Browne
Michael Healy
Bruce Cameron
Christopher Charlton

March 2011

We are grateful to the ESRC for their sustained support.

```
.dta", clear

nt: cons)
```

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MLwiN
File Edit Options Model Estimation Data Manipulation Basic Statistics Graphs Window Help
Start More Stop IGLS
Estimation control..
Resume macro
Abort Macro
Equations
$\text{normexam}_{ij} \sim \text{N}(XB, \Omega)$
$\text{normexam}_{ij} = \beta_{0ij}\text{cons}$
$\beta_{0ij} = \beta_0 + u_{0j} + e_{0ij}$
$\begin{bmatrix} u_{0j} \end{bmatrix} \sim \text{N}(0, \Omega_u) : \Omega_u = \begin{bmatrix} \sigma^2_{u0} \end{bmatrix}$
$\begin{bmatrix} e_{0ij} \end{bmatrix} \sim \text{N}(0, \Omega_e) : \Omega_e = \begin{bmatrix} \sigma^2_{e0} \end{bmatrix}$
Name + - Add Term Estimates Nonlinear Clear Notation Responses Store Help Zoom 100
random fixed iteration 0
Equations

MLwiN

File Edit Options Model Estimation Data Manipulation Basic Statistics Graphs Window Help

Start | More | Stop | IGLS | Estimation control.. | Resume macro | Abort Macro

Equations

$$\text{normexam}_{ij} \sim N(XB, \Omega)$$

$$\text{normexam}_{ij} = \beta_{0ij}\text{cons}$$

$$\beta_{0ij} = -0.013(0.054) + u_{0j} + e_{0ij}$$

$$\begin{bmatrix} u_{0j} \end{bmatrix} \sim N(0, \Omega_u) : \Omega_u = \begin{bmatrix} 0.169(0.032) \end{bmatrix}$$

$$\begin{bmatrix} e_{0ij} \end{bmatrix} \sim N(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.848(0.019) \end{bmatrix}$$

*-2*loglikelihood(IGLS Deviance)* = 11010.648(4059 of 4059 cases in use)

Name | + | - | Add Term | Estimates | Nonlinear | Clear | Notation | Responses | Store | Help | Zoom 100

random | fixed | iteration 3 | Equations

Stata/MP 11.1 - http://www.bristol.ac.uk/cmm/media/runmlwin/tutorial.dta - [Results]

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Review

	Command	_rc
1	use "http://www.bristol.ac.uk/cm...	
2	runmlwin normexam cons, level2(...	

Variables

Name	Label	Type	Format
school	School ID	byte	%9.0g
student	Student ID	int	%9.0g
normexam	Age 16 exam scor...	float	%9.0g
cons	Constant	byte	%9.0g
standlrt	Age 11 exam scor...	float	%9.0g
girl	Girl	byte	%9.0g
schgend	School gender	byte	%9.0g
avslrt	School average LR...	float	%9.0g
schav	School average LR...	byte	%9.0g
vrband	Age 11 verbal reas...	byte	%9.0g

```
. use "http://www.bristol.ac.uk/cmm/media/runmlwin/tutorial.dta", clear

. runmlwin normexam cons, level2(school: cons) level1(student: cons)

MLwiN 2.23 multilevel model                       Number of obs      =      4059
Normal response model
Estimation algorithm: IGLS
```

Group Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
school	65	2	62.4	198

```
Run time (seconds) =      80.97
Log likelihood     = -5505.3242
Deviance           =  11010.648
```

normexam	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	-.0131668	.0536254	-0.25	0.806	-.1182706	.091937

Random-effects Parameters		Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:	var(cons)	.1686251	.0324466	.1050309	.2322194
Level 1:	var(cons)	.8477613	.0189712	.8105786	.8849441

```
.
.
```

Command

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CAP NUM OVR

```
. use "http://www.bristol.ac.uk/cmm/media/runmlwin/tutorial.dta", clear

. runmlwin normexam cons, level2(school: cons) level1(student: cons)

MLwiN 2.23 multilevel model                       Number of obs      =      4059
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Level 1:	var(cons)	.8477613	.0189712	.8105786	.8849441

```
.
.
```

Command

The `runmlwin` command syntax

$$normexam_{ij} = \beta_0 + \beta_1 standlrt_{ij} + \beta_2 girl_{ij} + u_j + e_{ij}$$

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

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

```
. runmlwin normexam cons standlrt girl, ///
      level2(school: cons) ///
      level1(student: cons)
```

The `runmlwin` command syntax

$$normexam_{ij} = \beta_0 + \beta_1 standlrt_{ij} + \beta_2 girl_{ij} + u_{0j} + u_{1j} standlrt_{ij} + e_{ij}$$

$$\begin{pmatrix} u_{0j} \\ u_{1j} \end{pmatrix} \sim \mathrm{N}\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{u0} & \\ \sigma_{u01} & \sigma^2_{u1} \end{pmatrix} \right\}$$

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

```
. runmlwin normexam cons standlrt girl, ///
      level2(school: cons standlrt) ///
      level1(student: cons)
```

The `runmlwin` command syntax

$$normexam_{ij} = \beta_0 + \beta_1 standlrt_{ij} + \beta_2 girl_{ij} + u_{0j} + u_{1j} standlrt_{ij}$$

$$+e_{2ij} girl_{ij} + e_{3ij} boy_{ij}$$

$$\begin{pmatrix} u_{0j} \\ u_{1j} \end{pmatrix} \sim \mathrm{N}\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{u0} & \\ \sigma_{u01} & \sigma^2_{u1} \end{pmatrix} \right\}$$

$$\begin{pmatrix} e_{2j} \\ e_{3j} \end{pmatrix} \sim \mathrm{N}\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{e2} & \\ 0 & \sigma^2_{e3} \end{pmatrix} \right\}$$

```
. runmlwin normexam cons standlrt girl, ///
      level2(school: cons standlrt) ///
      level1(student: girl boy, diagonal)
```

The `runmlwin` command syntax

$$normexam_{ij} = \beta_0 + \beta_1 standlrt_{ij} + \beta_2 girl_{ij} + u_{0j} + u_{1j} standlrt_{ij}$$
$$+ e_{2ij} girl_{ij} + e_{3ij} boy_{ij}$$

$$\begin{pmatrix} u_{0j} \\ u_{1j} \end{pmatrix} \sim \mathrm{N}\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{u0} & \\ \sigma_{u01} & \sigma^2_{u1} \end{pmatrix} \right\}$$

$$\begin{pmatrix} e_{2j} \\ e_{3j} \end{pmatrix} \sim \mathrm{N}\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{e2} & \\ 0 & \sigma^2_{e3} \end{pmatrix} \right\}$$

```
. runmlwin normexam cons standlrt girl, ///
      level2(school: cons standlrt, residuals(u)) ///
      level1(student: girl boy, diagonal)
```

The `runmlwin` command syntax

$$normexam_{ij} = \beta_0 + \beta_1 standlrt_{ij} + \beta_2 girl_{ij} + u_{0j} + u_{1j} standlrt_{ij}$$
$$+ e_{2ij} girl_{ij} + e_{3ij} boy_{ij}$$

$$\begin{pmatrix} u_{0j} \\ u_{1j} \end{pmatrix} \sim \mathrm{N}\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{u0} & \\ \sigma_{u01} & \sigma^2_{u1} \end{pmatrix} \right\}$$

$$\begin{pmatrix} e_{2j} \\ e_{3j} \end{pmatrix} \sim \mathrm{N}\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{e2} & \\ 0 & \sigma^2_{e3} \end{pmatrix} \right\}$$

```
. runmlwin normexam cons standlrt girl, ///
      level2(school: cons standlrt, residuals(u)) ///
      level1(student: girl boy, diagonal) nopause
```

Stata/MP 11.1 - http://www.bristol.ac.uk/cmm/software/runmlwin/data/tutorial.dta - [Results]

File Edit Data Graphics Statistics User Window Help

Review

	Command	_rc
1	use "http://www.bristol.ac.uk/cm...	
2	runmlwin normexam cons, level2(...	
3	generate boy = 1 - girl	
4	runmlwin normexam cons standlrt...	

Variables

Name	Label	Type	Format
school	School ID	byte	%9.0g
student	Student ID	int	%9.0g
normexam	Age 16 exam scor...	float	%9.0g
cons	Constant	byte	%9.0g
standlrt	Age 11 exam scor...	float	%9.0g
girl	Girl	byte	%9.0g
schgend	School gender	byte	%9.0g
avslrt	School average LR...	float	%9.0g
schav	School average LR...	byte	%9.0g
vrband	Age 11 verbal reas...	byte	%9.0g
boy		float	%9.0g
u0	u0 residual estimate	float	%9.0g
u1	u1 residual estimate	float	%9.0g
u0se	u0se residual stan...	float	%9.0g
u1se	u1se residual stan...	float	%9.0g

```
. runmlwin normexam cons standlrt girl, level2(school: cons standlrt, residuals(
> u)) level1(student: girl boy, diagonal) nopause

MLwiN 2.23 multilevel model                     Number of obs      =      4059
Normal response model
Estimation algorithm: IGLS
```

Group Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
school	65	2	62.4	198

```
Run time (seconds) =      1.51
Log likelihood     =  -4640.71
Deviance           =  9281.4199
```

normexam	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	-.111534	.0433072	-2.58	0.010	-.1964145	-.0266536
standlrt	.5529361	.0200758	27.54	0.000	.5135882	.5922841
girl	.1752785	.0324156	5.41	0.000	.1117451	.238812

Random-effects Parameters		Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:					
	var(cons)	.0862511	.017175	.0525887	.1199135
	cov(cons,standlrt)	.0190537	.0066789	.0059632	.0321441
	var(standlrt)	.0148919	.0044702	.0061304	.0236534
Level 1:					
	var(girl)	.5251641	.0152836	.4952088	.5551194
	var(boy)	.5874345	.0209983	.5462786	.6285904

Command

C:\Users\gl9158\Documents

CAP NUM OVR

```
. runmlwin normexam cons standlrt girl, level2(school: cons standlrt, residuals(
> u)) level1(student: girl boy, diagonal) nopause

MLwiN 2.23 multilevel model                       Number of obs      =      4059
Normal response model
Estimation algorithm: IGLS
```

Group Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
school	**65**	**2**	**62.4**	**198**

```
Run time (seconds) =      1.51
Log likelihood     =  -4640.71
Deviance           =  9281.4199
```

normexam	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	-.111534	.0433072	-2.58	0.010	-.1964145	-.0266536
standlrt	.5529361	.0200758	27.54	0.000	.5135882	.5922841
girl	.1752785	.0324156	5.41	0.000	.1117451	.238812

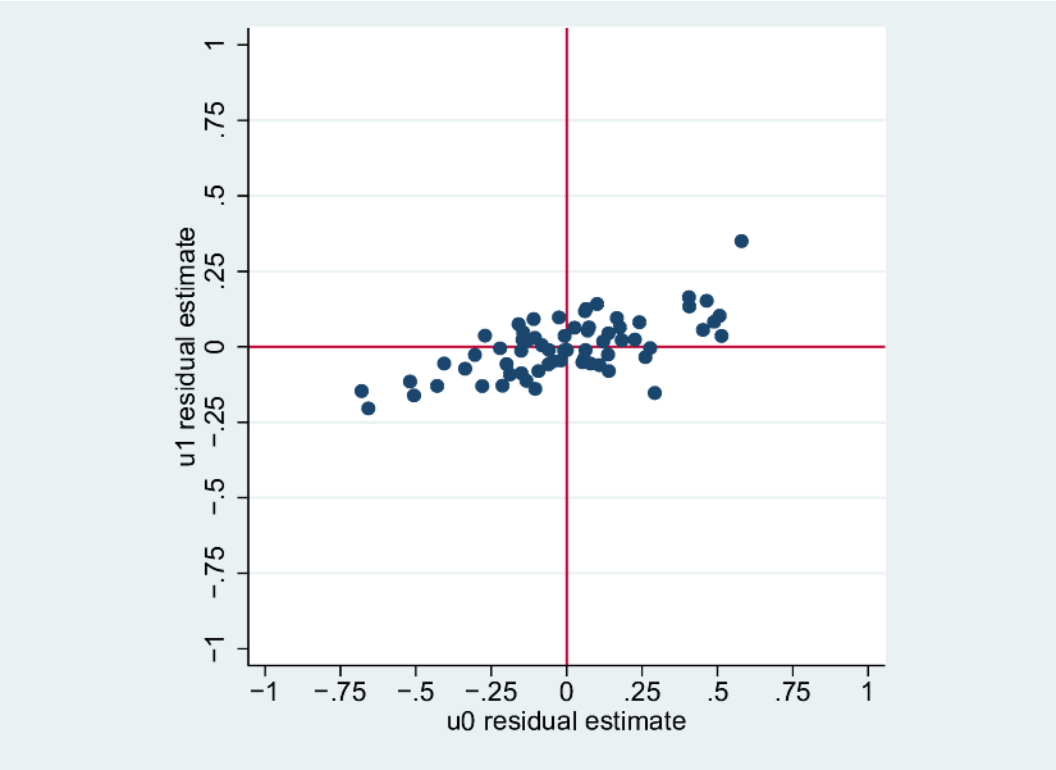
Random-effects Parameters		Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:					
	var(cons)	.0862511	.017175	.0525887	.1199135
	cov(cons,standlrt)	.0190537	.0066789	.0059632	.0321441
	var(standlrt)	.0148919	.0044702	.0061304	.0236534
Level 1:					
	var(girl)	.5251641	.0152836	.4952088	.5551194
	var(boy)	.5874345	.0209983	.5462786	.6285904

```
. test [RP1]var(girl) = [RP1]var(boy)

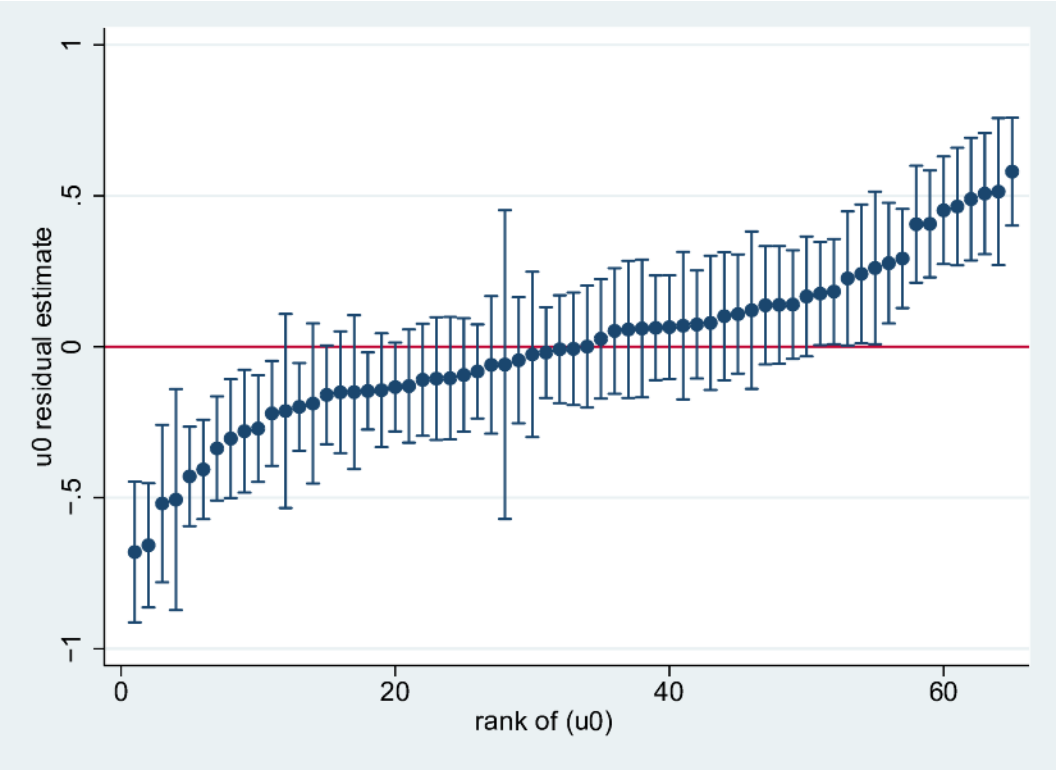
 ( 1)  [RP1]var(girl) - [RP1]var(boy) = 0

           chi2(  1) =    5.74
         Prob > chi2 =    0.0166
```

Command

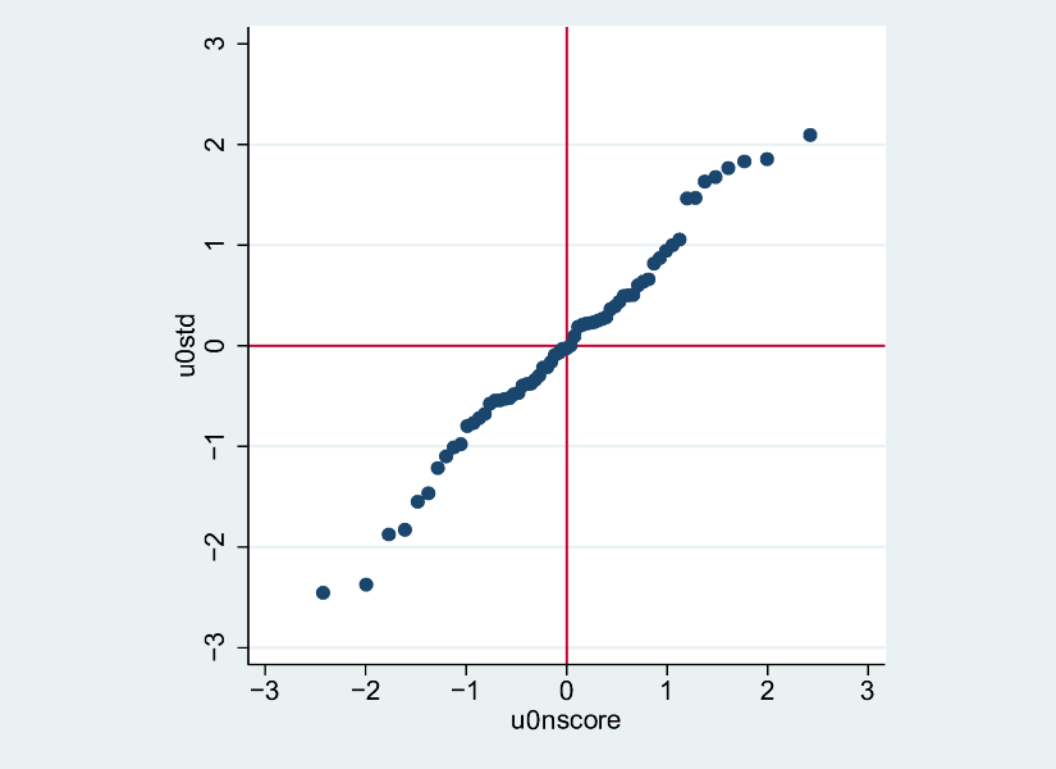



```
. scatter u1 u0, yline(0) xline(0) ///
      ylabel(-1(.25)1) xlabel(-1(.25)1) aspectratio(1)
```




```
. egen u0rank = rank(u0)

. serrbar u0 u0se u0rank, scale(1.96) yline(0)
```



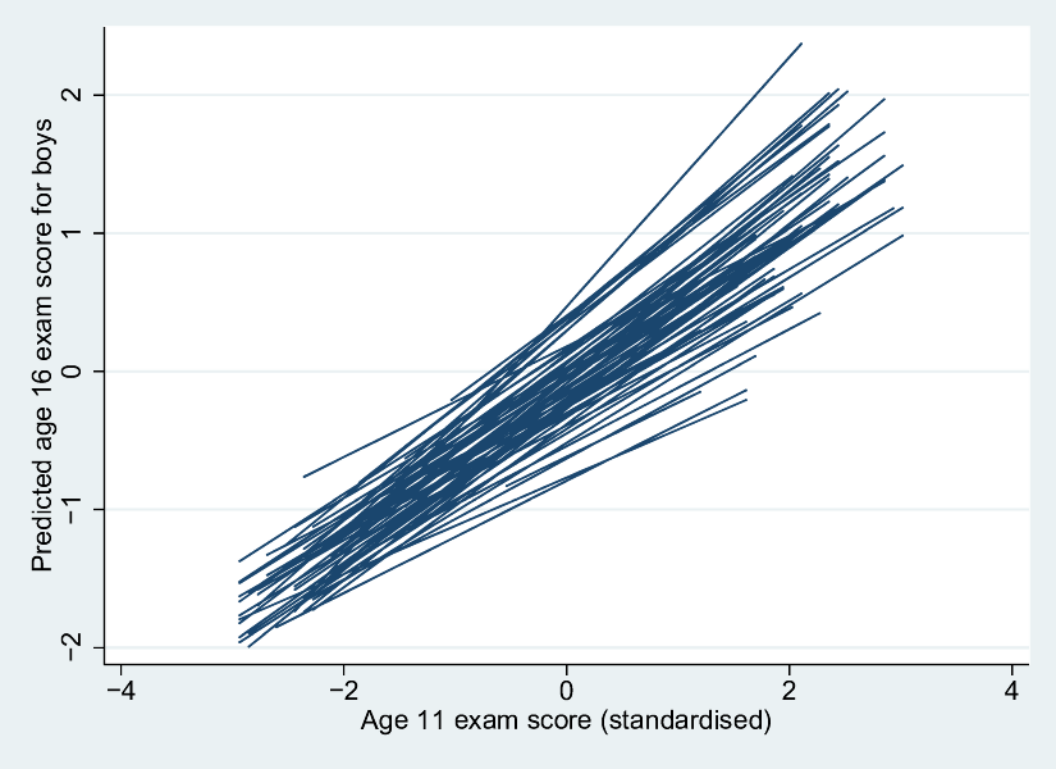

```
. summarize u0

. generate u0std = (u0 - r(mean))/r(sd)

. generate u0uniform = (u0rank - 0.5)/_N

. generate u0nscore = invnorm(u0uniform)

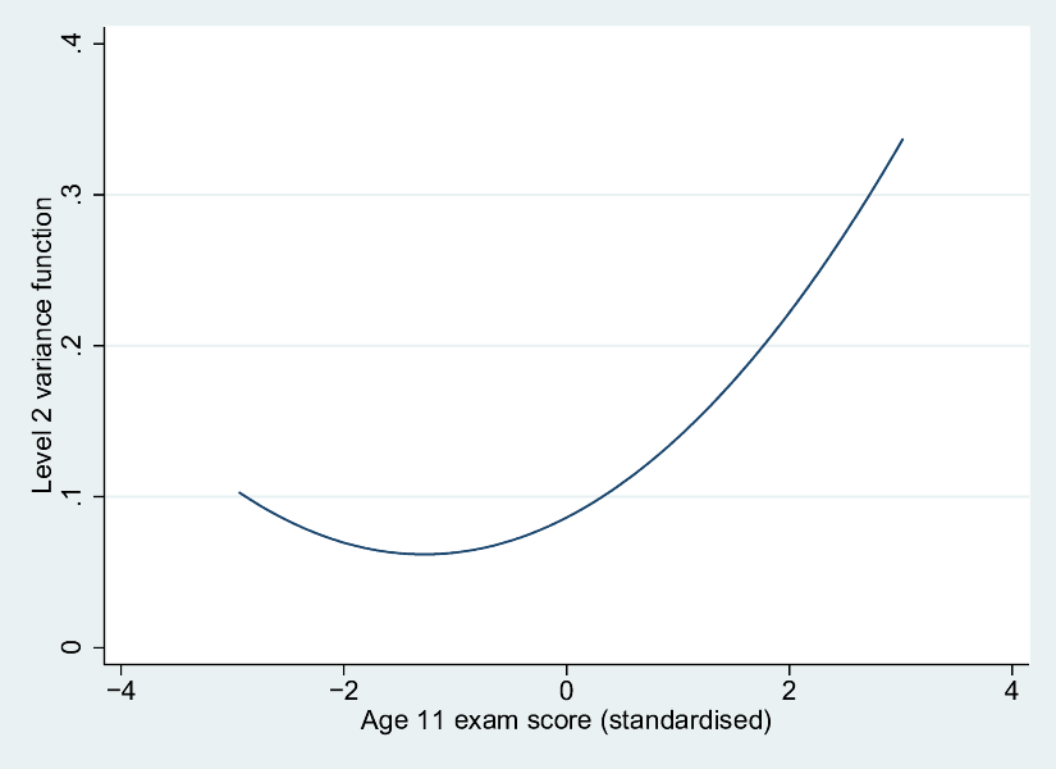
. scatter u0std u0nscore, yline(0) xline(0) ///
      ylabel(-3(1)3) xlabel(-3(1)3) aspectratio(1)
```




```
. generate prediction = _b[cons]*cons ///
      + _b[standlrt ]*standlrt + u0 + u1*standlrt

. sort school standlrt

. line xbu standlrt, connect(a) ///
      ytitle("Predicted age 16 exam score for boys")
```




```
. twoway (function [RP2]var(cons) + ///
      2*[RP2]cov(cons,standlrt)*x + ///
      [RP2]var(standlrt)*x^2, ///
      range(standlrt)), ///
      ytitle("Level 2 variance function") ///
      xtitle("Age 11 exam score (standardised)")
```

The `runmlwin` command syntax

$$binexam_{ij} \sim \text{Binomial}(1, \pi_{ij})$$

$$logit(\pi_{ij}) = \beta_0 + \beta_1 standlrt_{ij} + \beta_2 girl_{ij} + u_{0j} + u_{1j} standlrt_{ij}$$

$$\begin{pmatrix} u_{0j} \\ u_{1j} \end{pmatrix} \sim \text{N}\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{u0} & \\ \sigma_{u01} & \sigma^2_{u1} \end{pmatrix} \right\}$$

```
. runmlwin binexam cons standlrt girl, ///
      level2(school: cons standlrt) ///
      level1(student:) ///
      discrete(dist(binomial) link(logit) denom(cons))
```

The `runmlwin` command syntax

$$binexam_{ij} \sim \text{Binomial}(1, \pi_{ij})$$

$$logit(\pi_{ij}) = \beta_0 + \beta_1 standlrt_{ij} + \beta_2 girl_{ij} + u_{0j} + u_{1j} standlrt_{ij}$$

$$\begin{pmatrix} u_{0j} \\ u_{1j} \end{pmatrix} \sim \text{N}\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{u0} & \\ \sigma_{u01} & \sigma^2_{u1} \end{pmatrix} \right\}$$

```
. runmlwin binexam cons standlrt girl, ///
      level2(school: cons standlrt) ///
      level1(student:) ///
      discrete(d(binomial) l(logit) de(cons) pql2) ///
      initsprevious
```

```
. gen binexam = (normexam>0)

. runmlwin binexam cons standlrt girl, level2(school: cons standlrt) level1(stud
> ent:) discrete(distribution(binomial) link(logit) denominator(cons)) nopause

MLwiN 2.23 multilevel model                       Number of obs      =      4059
Binomial logit response model
Estimation algorithm: IGLS, MQL1
```

Group Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
school	**65**	**2**	**62.4**	**198**

binexam	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	-.0479964	.101761	-0.47	0.637	-.2474444	.1514515
standlrt	1.232918	.0581067	21.22	0.000	1.119031	1.346805
girl	.186636	.0956229	1.95	0.051	-.0007814	.3740534

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:				
var(cons)	.3701358	.0822183	.208991	.5312807
cov(cons,standlrt)	.0444551	.0394446	-.0328549	.121765
var(standlrt)	.06152	.0364277	-.009877	.1329169

```
.
.
.
```

Command

```
. runmlwin binexam cons standlrt girl, level2(school: cons standlrt) level1(stud
> ent:) discrete(distribution(binomial) link(logit) denominator(cons) pql2) init
> sprevious nopause

Model fitted using initial values specified as parameter estimates from previous
>  model

MLwiN 2.23 multilevel model                       Number of obs      =      4059
Binomial logit response model
Estimation algorithm: IGLS, PQL2
```

Group Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
school	**65**	**2**	**62.4**	**198**

binexam	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	-.0367105	.1120693	-0.33	0.743	-.2563622	.1829413
standlrt	1.358886	.0642726	21.14	0.000	1.232914	1.484858
girl	.2012481	.1013948	1.98	0.047	.0025179	.3999782

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:				
var(cons)	.4740776	.1031501	.2719071	.676248
cov(cons,standlrt)	.0625434	.0491646	-.0338175	.1589043
var(standlrt)	.0764959	.0443148	-.0103596	.1633514

```
.
```

Command

Do-file Editor - rodriguez and goldman (1995).do

File Edit Tools View

rodriguez and goldman (1995).do

```
set seed 12345
postfile MQL1 ix fx cx sigmaf sigmac using "MQL1.dta", replace
set obs 2
generate cx = _n - 1
expand 10
sort cx
generate cid = _n
expand 2
bysort cid: gen fx = _n - 1
expand 10
bysort cid (fx): generate fid = _n
expand 2
bysort cid fid: gen ix = _n - 1
expand 10
bysort cid fid (ix): gen iid = _n
generate cons = 1
forvalues iteration = 1/100 {
    display _n(5) as txt "Iteration " as res "`iteration'" as txt " of " as res "100"
    generate c = rnormal(0,1)
    bysort cid (fid iid): replace c = c[1]
    generate f = rnormal(0,1)
    bysort cid fid (iid): replace f = f[1]
    generate y = rbinomial(1,invlogit(0*cons + 1*ix + 1*fx + 1*cx + f + c))
    runmlwin y cons ix fx cx, level3(cid: cons) level2(fid: cons) level1(iid:) ///
        discrete(distribution(binomial) link(logit) denominator(cons)) ///
        nopause
    post MQL1 ([FP1]ix) ([FP1]fx) ([FP1]cx) (sqrt([RP2]var(cons))) (sqrt([RP3]var(cons)))
    drop c f y
}
postclose MQL1
use "MQL1.dta", clear
tabstat ix fx cx sigmaf sigmac, format(%3.2f)
```

Ready

Line: 24, Col: 0 CAP NUM OVR

The `runmlwin` command syntax

$$binexam_{ij} \sim \text{Binomial}(1, \pi_{ij})$$

$$logit(\pi_{ij}) = \beta_0 + \beta_1 standlrt_{ij} + \beta_2 girl_{ij} + u_{0j} + u_{1j} standlrt_{ij}$$

$$\begin{pmatrix} u_{0j} \\ u_{1j} \end{pmatrix} \sim \text{N}\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{u0} & \\ \sigma_{u01} & \sigma^2_{u1} \end{pmatrix} \right\}$$

```
. runmlwin binexam cons standlrt girl, ///
      level2(school: cons standlrt) ///
      level1(student:) ///
      discrete(d(binomial) l(logit) de(cons)) ///
      mcmc(burnin(500) chain(5000)) initsprevious
```

```
. runmlwin binexam cons standlrt girl, level2(school: cons standlrt) level1(stud
> ent:) discrete(distribution(binomial) link(logit) denominator(cons)) mcmc(burn
> in(500) chain(5000)) initsprevious nopause

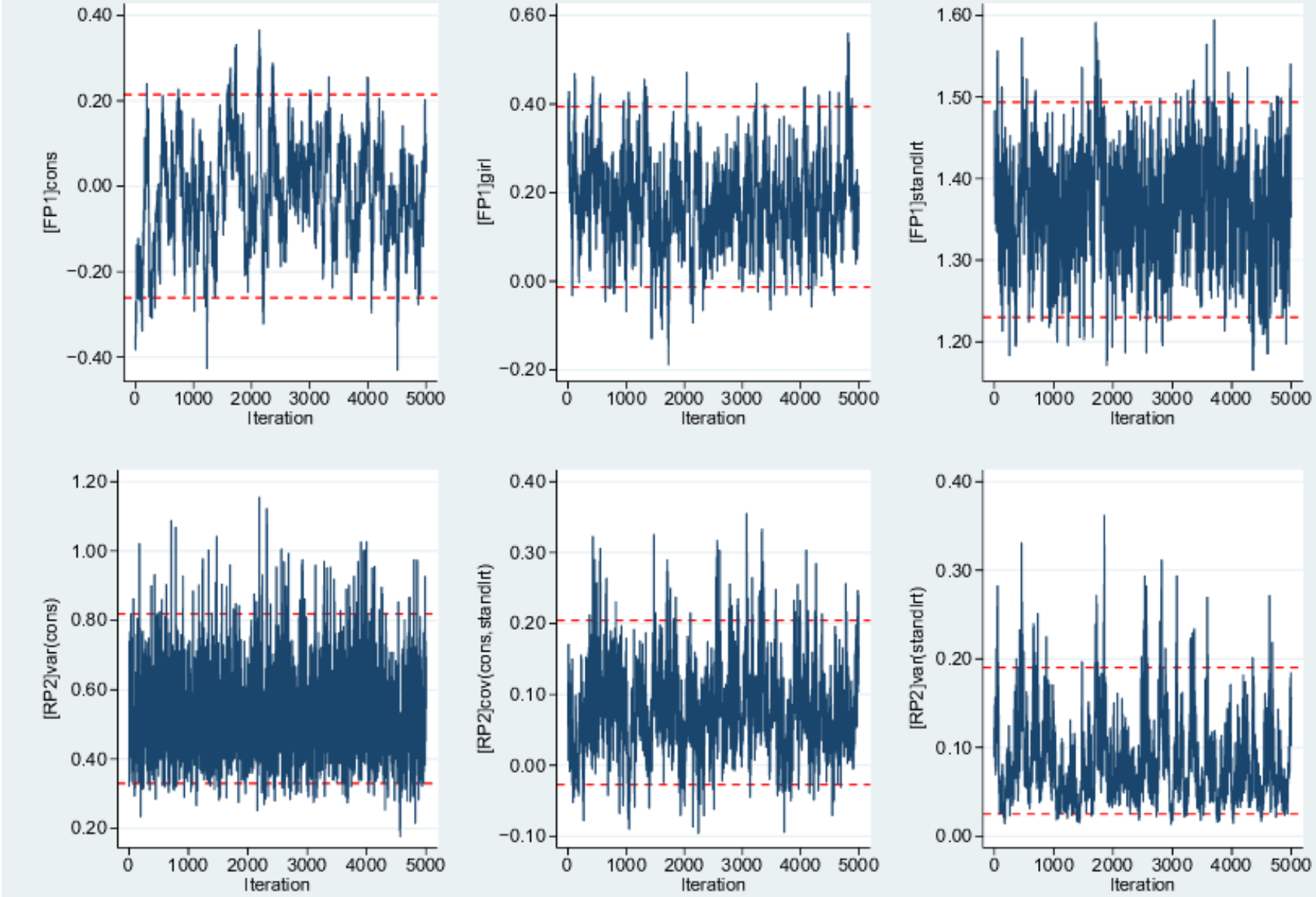
MLWiN 2.23 multilevel model                       Number of obs      =      4059
Binomial logit response model
Estimation algorithm: MCMC
```

Group Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
school	**65**	**2**	**62.4**	**198**

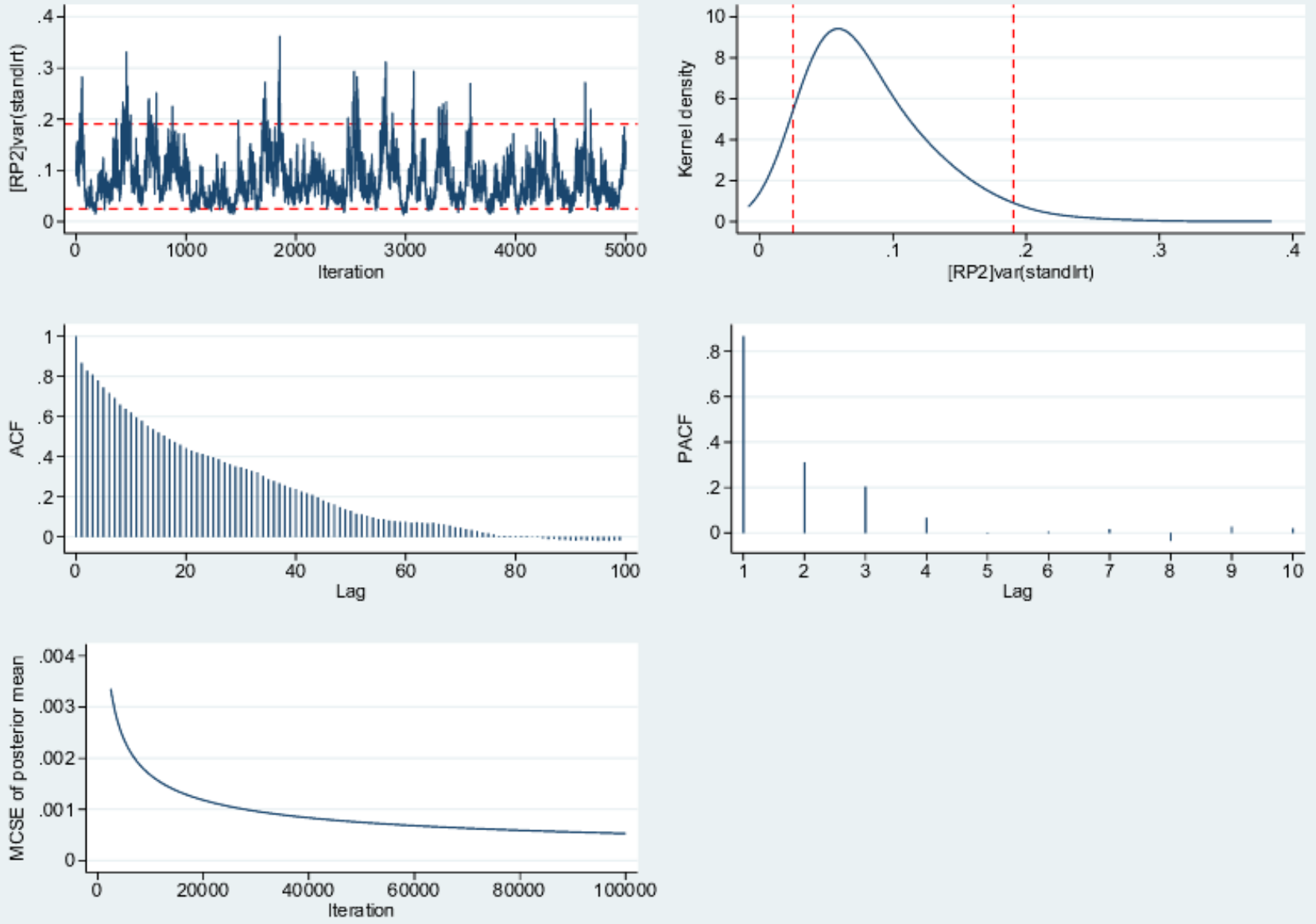
Burnin	=	500
Chain	=	5000
Run time (seconds)	=	26.7
Deviance (dbar)	=	4233.95
Deviance (thetabar)	=	4161.33
Effective no. of pars (pd)	=	72.61
Bayesian DIC	=	4306.56

binexam	Mean	Std. Dev.	z	ESS	[95% Cred.	Interval]
cons	-.0416241	.1185963	-0.35	85	-.276969	.175749
standlrt	1.360427	.0644615	21.10	459	1.235198	1.495695
girl	.1988654	.1030964	1.93	153	.0059188	.3971115

Random-effects Parameters	Mean	Std. Dev.	ESS	[95% Cred.	Int]
Level 2:					
var(cons)	.5208298	.1229439	1122	.3272573	.7977266
cov(cons,standlrt)	.0690709	.0570959	193	-.0277179	.1940791
var(standlrt)	.0803482	.0471871	97	.0215764	.2014529




```
. mcmcsum, trajectories
```




```
. mcmcsum [RP2]var(standlrt), fiveplot
```

The `runmlwin` command syntax

$$binexam_{ij} \sim \text{Binomial}(1, \pi_{ij})$$

$$logit(\pi_{ij}) = \beta_0 + \beta_1 standlrt_{ij} + \beta_2 girl_{ij} + u_{0j} + u_{1j} standlrt_{ij}$$

$$\begin{pmatrix} u_{0j} \\ u_{1j} \end{pmatrix} \sim \text{N}\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma^2_{u0} & \\ \sigma_{u01} & \sigma^2_{u1} \end{pmatrix} \right\}$$

```
. runmlwin binexam cons standlrt girl, ///
        level2(school: cons standlrt) ///
        level1(student:) ///
        discrete(d(binomial) l(logit) de(cons)) ///
        mcmc(b(500) c(5000) savebugs(myfile.txt)) ///
        initsprevious
```

WinBUGS14

File Tools Edit Attributes Info Model Inference Options Doodle Map Text Window Help

myfile.txt

```
# WINBUGS 1.4 code generated from MLwiN program

#----MODEL Definition----------

model
{
# Level 1 definition
for(i in 1:N) {
binexam[i] ~ dbin(p[i],denom[i])
logit(p[i]) <- beta[1] * cons[i]
+ beta[2] * standlrt[i]
+ beta[3] * girl[i]
+ u2[school[i],1] * cons[i]
+ u2[school[i],2] * standlrt[i]
}
# Higher level definitions
for (j in 1:n2) {
u2[j,1:2] ~ dmnorm(zero2[1:2],tau.u2[1:2,1:2])
}
# Priors for fixed effects
for (k in 1:3) { beta[k] ~ dflat() }
# Priors for random terms
for (i in 1:2) {zero2[i] <- 0}
tau.u2[1:2,1:2] ~ dwish(R2[1:2, 1:2],2)
sigma2.u2[1:2,1:2] <- inverse(tau.u2[,])
}

#----Initial values file---------------------------

list(beta= c(-0.047996,1.232918,0.186636),
u2 = structure(.Data=c(0.120594,0.021080,0.089123,0.028229,0.170610,-0.044178,-
```

Do-file Editor - Amsterdam2011.do

File Edit Tools View

Amsterdam2011.do

```
use "http://www.bristol.ac.uk/cmm/media/runmlwin/tutorial.dta", clear
runmlwin normexam cons, level2(school: cons) level1(student: cons)
generate boy = 1 - girl
runmlwin normexam cons standlrt girl, level2(school: cons) level1(student: girl boy, diagonal) nopause
runmlwin normexam cons standlrt girl, level2(school: cons standlrt, residuals(u)) level1(student: girl boy, dia
test [RP1]var(girl) = [RP1]var(boy)
preserve
egen pickone = tag(school)
keep if pickone==1
scatter u1 u0, yline(0) xline(0) ylabel(-1(.25)1) xlabel(-1(.25)1) aspectratio(1)
egen u0rank = rank(u0)
serrbar u0 u0se u0rank, scale(1.96) yline(0)
summarize u0
generate u0std = (u0 - r(mean))/r(sd)
generate u0uniform = (u0rank - 0.5)/_N
generate u0nscore = invnorm(u0uniform)
scatter u0std u0nscore, yline(0) xline(0) ylabel(-3(1)3) xlabel(-3(1)3) aspectratio(1)
restore
generate prediction = _b[cons]*cons + _b[standlrt ]*standlrt + u0 + u1*standlrt
sort school standlrt
line prediction standlrt, connect(a) ytitle("Predicted age 16 exam score for boys")
twoway (function [RP2]var(cons) + 2*[RP2]cov(cons,standlrt)*x + [RP2]var(standlrt)*x^2, range(standlrt)), ytitl
gen binexam = (normexam>0)
runmlwin binexam cons standlrt girl, level2(school: cons standlrt) level1(student:) discrete(distribution(binom
runmlwin binexam cons standlrt girl, level2(school: cons standlrt) level1(student:) discrete(distribution(binom
runmlwin binexam cons standlrt girl, level2(school: cons standlrt) level1(student:) discrete(distribution(binom
runmlwin binexam cons standlrt girl, level2(school: cons standlrt) level1(student:) discrete(distribution(binom
mcmcsum, trajectories
mcmcsum [RP2]var(cons), fiveway
mcmcsum [RP2]var(cons)
```

Ready

Line: 1, Col: 0 CAP NUM OVR

help for **runmlwin**

Title

runmlwin - Running the MLwiN multilevel modelling package from within Stata

Syntax

runmlwin *responses_and_fixed_part*, *random_part* [discrete(*discrete_options*)] [*options*]

where the syntax of *responses_and_fixed_part* is one of the following

for univariate response models

depvar indepvars [*if*] [*in*]

for multivariate response models

(*depvar1 indepvars1*, **equation(***numlist***)**)
(*depvar2 indepvars2*, **equation(***numlist***)**)
[(*depvar3 indepvars3*, **equation(***numlist***)**)]
[...]
[*if*] [*in*]

where **equation(***numlist***)** specifies equation numbers.

for multinomial response models

depvar indepvars1 [(*indepvars2*, **contrast(***numlist***)**) ...] [*if*] [*in*]

where *indepvars1* are those independent variables which appear with separate coefficients in every log-odds contrast, while *indepvars2* are those independent variables which appear with common coefficients for those log-odds contrasts specified in **contrast(***numlist***)**. Contrasts can be thought of as the separate "subequations" or "arms" of a multinomial response model.

and the syntax of *random_part* is

[...] [level2(*levelvar*: [*varlist*] [, *random_part_options*])]
level1(*levelvar*: [*varlist*] [, *random_part_options*])

where *levelvar* is a variable identifying the groups or clusters for the random effects at each level. *varlist* is the list of variables with random coefficients at each level.

Examples

IMPORTANT. The following examples will only work on your computer once you have installed MLwiN and once you have told **runmlwin** the mlwin.exe file address. See **Remarks on installation instructions** above.

(a) Continuous response models

Two-level models

Setup

```
. use http://www.bristol.ac.uk/cmm/media/runmlwin/tutorial, clear
```

Two-level random-intercept model, analogous to xtreg.
(See page 28 of the MLwiN User Manual)
(You will need to click the "Resume macro" button twice in MLwiN to fit the model.)

```
. runmlwin normexam cons standlrt, level2(school: cons) level1(student: cons)
```

Two-level random-intercept and random-slope (coefficient) model
(See page 59 of the MLwiN User Manual)

```
. runmlwin normexam cons standlrt, level2 (school: cons standlrt) level1 (student: cons)
```

Refit the model, where this time we additionally calculate the level 2 residuals
(See page 59 of the MLwiN User Manual)

```
. runmlwin normexam cons standlrt, level2 (school: cons standlrt, residuals(u)) level1 (student: cons)
```

Refit the model surpressing the two pauses in MLwiN
(See page 59 of the MLwiN User Manual)

```
. runmlwin normexam cons standlrt, level2 (school: cons standlrt) level1 (student: cons) nopause
```

Two-level random-intercept and random-slope (coefficient) model with a complex level 1 variance function
(See page 99 of the MLwiN User Manual)

```
. matrix A = (1,1,0,0,0,1)
. runmlwin normexam cons standlrt girl,) level2(school: cons standlrt) level1(student: cons standlrt
    girl, elements(A))
```

Multivariate response models

Setup

```
. use http://www.bristol.ac.uk/cmm/media/runmlwin/gcsemv1, clear
```

Random-intercept bivariate response model
(See page 214 of the MLwiN User Manual)

```
. runmlwin (written cons female, eq(1)) (csework cons female, eq(2)), level2(school: (cons, eq(1)) (cons,
    eq(2))) level1(student:   (cons, eq(1)) (cons, eq(2)))
```

Cross-classified models

SOFTWARE

- MLwiN
- Realcom
- MLPowSim
- runmlwin
- CMM software support

University home > Centre for Multilevel Modelling... > Software > runmlwin

runmlwin: Running MLwiN from within Stata

runmlwin is a user written Stata command to fit multilevel models in MLwiN from within Stata. Models can be fit to both hierarchical and non-hierarchical (cross-classified and multiple membership) data structures and to both univariate and multivariate responses. Models can be fit to continuous, categorical (binary, proportion, nominal, ordinal) and count data.

The multilevel models fitted by **runmlwin** are analogous to those fitted by the Stata's **xtmixed, xtmelogit** and **xtmepoisson** commands and by the user written **gllamm** command.

running the **runmlwin** command in Stata carries out the following steps:

1. Writes an MLwiN macro for the specified multilevel model.
2. Opens MLwiN and runs the MLwiN macro.
3. Pauses MLwiN once the model is specified. This allows the user to check that the model is specified as expected.
4. Fits the model in MLwiN.
5. Pauses MLwiN once the model has been fitted (i.e. converged). This allows the user to examine the model results.
6. Stores and displays the model results in Stata

MLwiN and Stata are both required to use **runmlwin.**

Download

runmlwin is now available as a beta release. Users should be able to fit all models in the MLwiN User Manual. We are currently developing **runmlwin** so that users will soon be able to additionally fit all models in the MCMC MLwiN Manual.

We must stress that **runmlwin** is a free command and comes with no warranty. Users should always check their results with those obtained through operating MLwiN by its graphical user interface. Users are also encouraged to check their results with those produced by other statistical software packages.

To download **runmlwin**, issue the following command in a net aware version of Stata and follow the onscreen instructions:

```
. net from http://www.bristol.ac.uk/cmm/media/runmlwin
```