Running MLwiN from within Stata: the `runmlwin` command

MUGS, Department of Social Medicine,
University of Bristol
14th June 2011

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

INTRODUCTION

Existing multilevel modelling commands in Stata

- Stata provide the `xtmixed`, `xtmelogit` and `xtmepoisson` commands to fit multilevel models
  - Limited range of models can be specified
  - Computationally quite slow to fit models
- Sophia Rabe-Hesketh and Anders Skrondal provide the `gllamm` command
  - Wide range of models can be specified
  - Computationally slow to fit models
- Other user-written multilevel modelling commands include: `hlm`, `realcomimpute`, `runmplus`, `sabre`, `winbugs`

Multilevel modelling in MLwiN

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

2. Constraints allowing models such as the social relations models and behavioural genetics models to be formulated as multilevel models

3. Fast estimation via classical and Bayesian methods

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

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

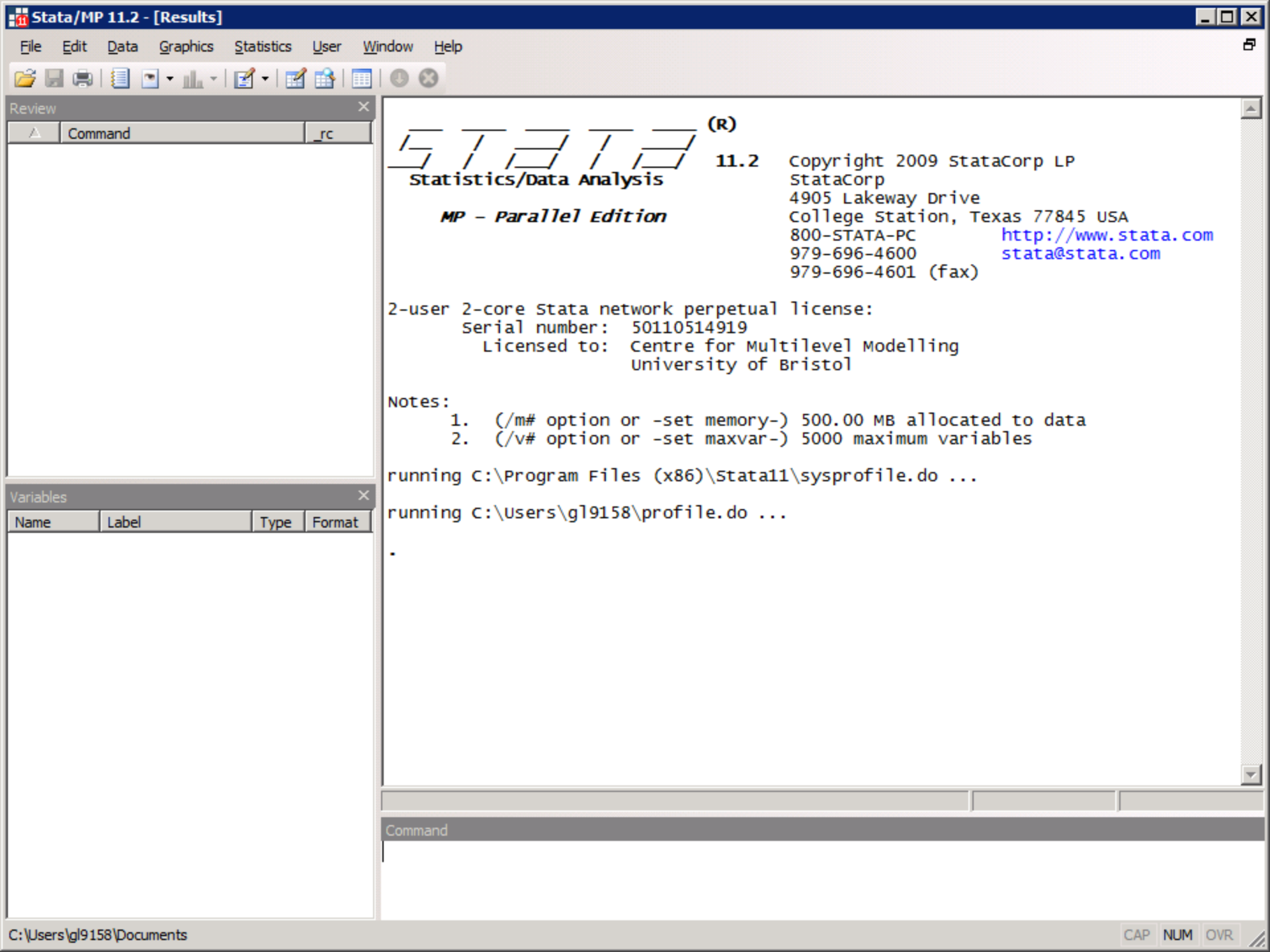
Examples

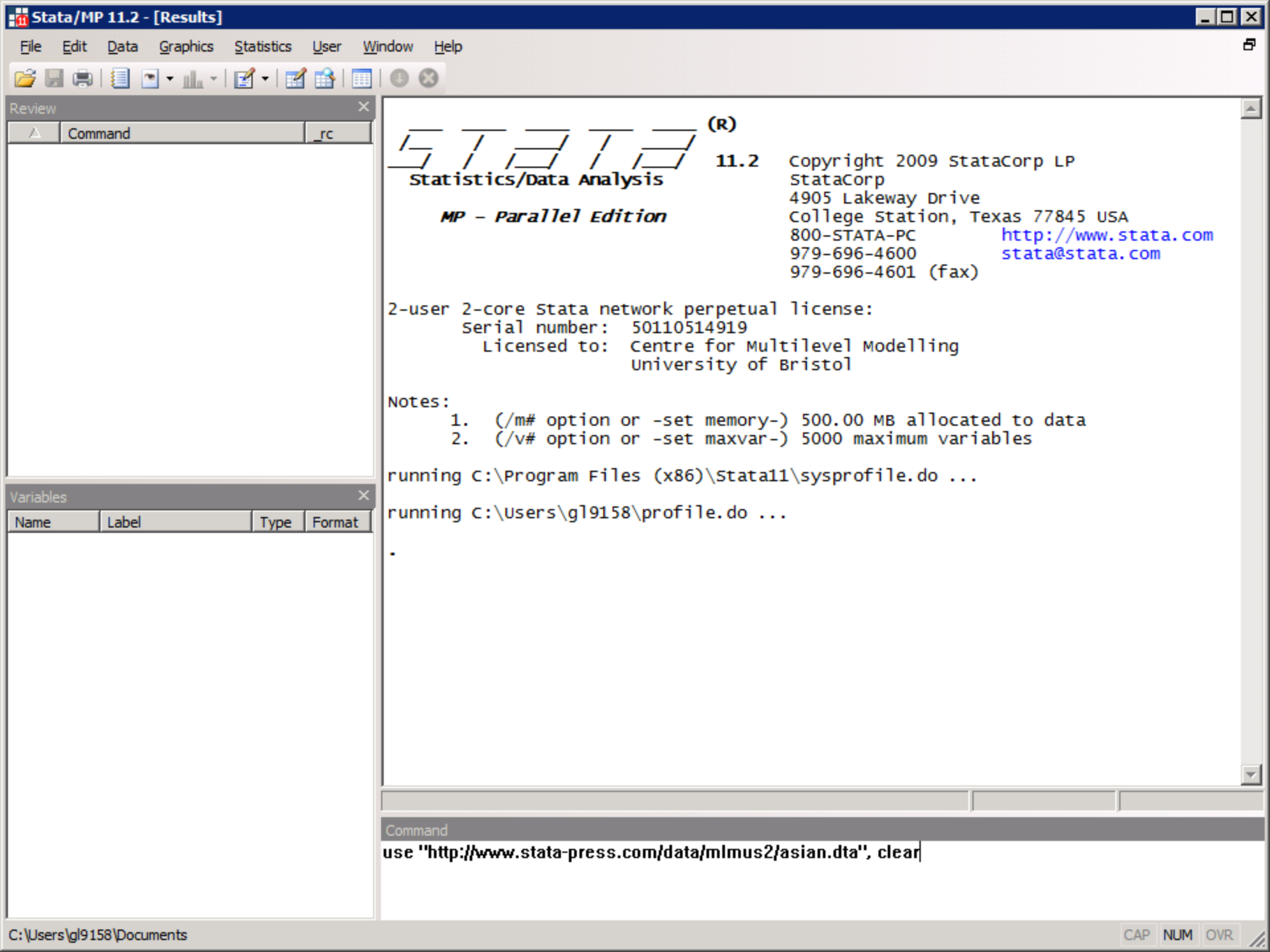
1. Growth curve models
2. Multilevel models for binary responses
3. Simulation studies are easy
4. MCMC estimation
5. Work efficiently
6. Resources to help you learn `runmlwin`

1. GROWTH CURVE MODELS

Child weight data

- Weight gain of Asian children in a British community
- 68 children, one to five measurements per child
- First analysed by Goldstein (1986)
- Re-analysed by Rabe-Hesketh and Skrondal (2008) and others


Stata/MP 11.2 - [Results]
File Edit Data Graphics Statistics User Window Help
Review
Command _rc
Variables
Name Label Type Format
(R)
11.2
Statistics/Data Analysis
MP - Parallel Edition
Copyright 2009 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: 50110514919
Licensed to: Centre for Multilevel Modelling
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 11.2 - [Results]
File Edit Data Graphics Statistics User Window Help
Review
Command _rc
Variables
Name Label Type Format
(R)
11.2
Statistics/Data Analysis
MP - Parallel Edition
Copyright 2009 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: 50110514919
Licensed to: Centre for Multilevel Modelling
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
use "http://www.stata-press.com/data/mlmus2/asian.dta", clear
C:\Users\gl9158\Documents
CAP NUM OVR

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

Review

	Command	_rc
1	use "http://www.stata-press.co...	

Variables

Name	Label	Type	Format
id		int	%8.0g
occ		byte	%9.0g
age		float	%8.0g
weight		float	%8.0g
brthwt		int	%8.0g
gender		int	%8.0g

```
  ___  ____  ____  ____  ____ (R)
 /__    /   ____/   /   ____/
___/   /   /___/   /   /___/   11.2   Copyright 2009 StataCorp LP
  Statistics/Data Analysis            StataCorp
                                      4905 Lakeway Drive
     MP - Parallel Edition            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:  50110514919
         Licensed to:  Centre for Multilevel Modelling
                       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 ...

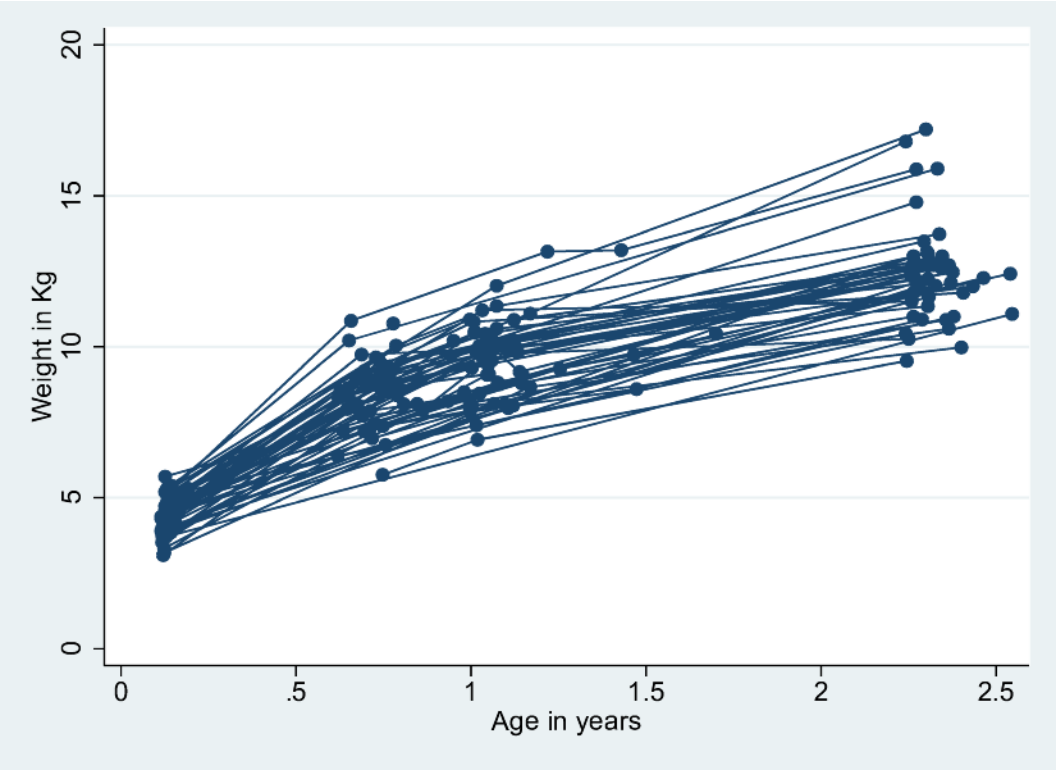
. use "http://www.stata-press.com/data/mlmus2/asian.dta", clear

.
```

Command

C:\Users\gl9158\Documents

CAP NUM OVR




- ```
  graph twoway ///
      (connect weight age, connect(ascending)), ///
      ytitle("Weight in Kg") xtitle("Age in years")
  ```
  ```

Random intercepts model

$$weight_{ij} = \beta_0 + \beta_1 age_{ij} + \beta_2 age_{ij}^2 + u_j + e_{ij}$$

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

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

```
. generate cons = 1

. generate age2 = age^2


. runmlwin weight cons age age2, ///
      level2(id: cons) ///
      level1(occ: cons)
```

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

Review

	Command	_rc
1	use "http://www.stata-press.co...	
2	graph twoway (connect weight a...	
3	generate cons = 1	
4	generate age2 = age^2	

Variables

Name	Label	Type	Format
id		int	%8.0g
occ		byte	%9.0g
age		float	%8.0g
weight		float	%8.0g
brthwt		int	%8.0g
gender		int	%8.0g
cons		float	%9.0g
age2		float	%9.0g

```
  ___  ____  ____  ____  ____ (R)
 /__    /   ____/   /   ____/
___/   /   /___/   /   /___/   11.2   Copyright 2009 StataCorp LP
  Statistics/Data Analysis            StataCorp
                                      4905 Lakeway Drive
     MP - Parallel Edition            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:  50110514919
         Licensed to:  Centre for Multilevel Modelling
                       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 ...

. use "http://www.stata-press.com/data/mlmus2/asian.dta", clear

. graph twoway (connect weight age, connect(ascending)), ytitle("Weight in Kg")
> xtitle("Age in years")

. generate cons = 1

. generate age2 = age^2

.
```

Command

```
runmlwin weight cons age age2, level2(id: cons) level1(occ: cons)
```

C:\Users\gl9158\Documents

CAP NUM OVR

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

Review

	Command	_rc
1	use "http://www.stata-press.co...	
2	graph twoway (connect weight a...	
3	generate cons = 1	
4	gene	
5	runm	

Variables

Name
id
occ
age
weight
brthwt
gender
cons
age2

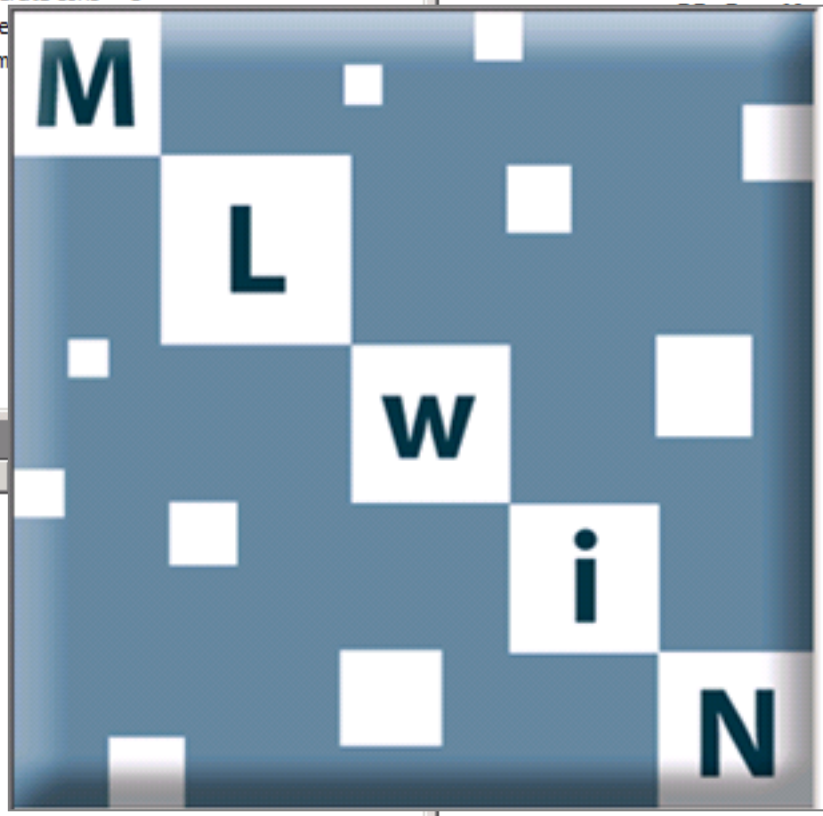
(R)

Statistics/Data Analysis 11.2

Copyright 2009 StataCorp LP
StataCorp
4905 Lakeway Drive

.com

Kg")



MLwiN

Version 2.23

© Centre for Multilevel Modelling
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.

Command

C:\Users\gl9158\Documents

CAP NUM OVR

MLwiN - [Equations]
File Edit Options Model Estimation Data Manipulation Basic Statistics Graphs Window Help
Start More Stop IGLS
Estimation control..
Resume macro
Abort Macro
$\text{weight}_{ij} \sim \text{N}(XB, \Omega)$
$\text{weight}_{ij} = \beta_{0ij}\text{cons} + \beta_1\text{age}_{ij} + \beta_2\text{age2}_{ij}$
$\beta_{0ij} = \beta_0 + u_{0j} + e_{0ij}$
$\begin{bmatrix} u_{0j} \end{bmatrix} \sim \text{N}(0, \Omega_u) : \Omega_u = \begin{bmatrix} \sigma^2_{u0} \end{bmatrix}$
$\begin{bmatrix} e_{0ij} \end{bmatrix} \sim \text{N}(0, \Omega_e) : \Omega_e = \begin{bmatrix} \sigma^2_{e0} \end{bmatrix}$
Name + - Add Term Estimates Nonlinear Clear Notation Responses Store Help Zoom 150
random fixed iteration 0
Equations

MLwiN - [Equations]
File Edit Options Model Estimation Data Manipulation Basic Statistics Graphs Window Help
Start More Stop IGLS
Estimation control..
Resume macro
Abort Macro
$\text{weight}_{ij} \sim \text{N}(XB, \Omega)$
$\text{weight}_{ij} = \beta_{0ij}\text{cons} + 7.818(0.290)\text{age}_{ij} + -1.706(0.109)\text{age2}_{ij}$
$\beta_{0ij} = 3.433(0.181) + u_{0j} + e_{0ij}$
$\begin{bmatrix} u_{0j} \end{bmatrix} \sim \text{N}(0, \Omega_u) : \Omega_u = \begin{bmatrix} 0.843(0.180) \end{bmatrix}$
$\begin{bmatrix} e_{0ij} \end{bmatrix} \sim \text{N}(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.540(0.067) \end{bmatrix}$
-2*loglikelihood(IGLS Deviance) = 553.665(198 of 198 cases in use)
Name + - Add Term Estimates Nonlinear Clear Notation Responses Store Help Zoom 150
random fixed iteration 3 Equations

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

Review

	Command	_rc
1	use "http://www.stata-press.co...	
2	graph twoway (connect weight a...	
3	generate cons = 1	
4	generate age2 = age^2	
5	runmlwin weight cons age age2, l...	

Variables

Name	Label	Type	Format
id		int	%8.0g
occ		byte	%9.0g
age		float	%8.0g
weight		float	%8.0g
brthwt		int	%8.0g
gender		int	%8.0g
cons		float	%9.0g
age2		float	%9.0g

```
. runmlwin weight cons age age2, level2(id: cons) level1(occ: cons)

MLwiN 2.23 multilevel model                       Number of obs      =       198
Normal response model
Estimation algorithm: IGLS
```

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
id	68	1	2.9	5

```
Run time (seconds)   =     103.67
Number of iterations =          3
Log likelihood       = -276.83267
Deviance             =  553.66534
```

weight	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	3.432849	.1810731	18.96	0.000	3.077953	3.787746
age	7.817935	.2896442	26.99	0.000	7.250243	8.385628
age2	-1.705607	.1085952	-15.71	0.000	-1.918449	-1.492764

Random-effects Parameters		Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:	var(cons)	.8432966	.1801572	.490195	1.196398
Level 1:	var(cons)	.5397546	.0669848	.4084669	.6710423

```
.
```

Command

C:\Users\gl9158\Documents

CAP NUM OVR

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

```
. runmlwin weight cons age age2, level2(id: cons) level1(occ: cons)

MLwiN 2.23 multilevel model                     Number of obs      =       198
Normal response model
Estimation algorithm: IGLS
```

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
id	68	1	2.9	5

```
Run time (seconds)    =     103.67
Number of iterations  =          3
Log likelihood        = -276.83267
Deviance              =  553.66534
```

weight	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	3.432849	.1810731	18.96	0.000	3.077953	3.787746
age	7.817935	.2896442	26.99	0.000	7.250243	8.385628
age2	-1.705607	.1085952	-15.71	0.000	-1.918449	-1.492764

Random-effects Parameters		Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:	var(cons)	.8432966	.1801572	.490195	1.196398
Level 1:	var(cons)	.5397546	.0669848	.4084669	.6710423

C:\Users\gl9158\Documents

CAP NUM OVR

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

```
. lincom 1*cons + 2*age + 4*age2

 ( 1)  [FP1]cons + 2*[FP1]age + 4*[FP1]age2 = 0
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
(1)	12.24629	.1414437	86.58	0.000	11.96907	12.52352

C:\Users\gl9158\Documents

CAP NUM OVR

Growth curve model

$$weight_{ij} = \beta_0 + \beta_1 age_{ij} + \beta_2 age_{ij}^2 + u_{0j} + u_{1j} age_{ij} + e_{ij}$$

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

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

```
. runmlwin weight cons age age2, ///
      level2(id: cons age) ///
      level1(occ: cons) nopause
```

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

MLwiN 2.23 multilevel model
Normal response model
Estimation algorithm: **IGLS**

Number of obs = **198**

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
id	**68**	**1**	**2.9**	**5**

Run time (seconds) = **1.44**
Number of iterations = **7**
Log likelihood = **-258.07785**
Deviance = **516.1557**

weight	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	3.494518	.1372489	25.46	0.000	3.225515	3.76352
age	7.704002	.2394275	32.18	0.000	7.234733	8.173271
age2	-1.660475	.0885319	-18.76	0.000	-1.833994	-1.486955

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:				
var(cons)	.4040045	.1412488	.1271619	.6808471
cov(cons,age)	.088273	.0812774	-.0710279	.2475738
var(age)	.2539857	.0858503	.0857222	.4222493
Level 1:				
var(cons)	.331641	.0532307	.2273107	.4359712

C:\Users\gl9158\Documents

CAP NUM OVR

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

```
. runmlwin, sd

MLwiN 2.23 multilevel model                       Number of obs      =       198
Normal response model
Estimation algorithm: IGLS
```

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
id	68	1	2.9	5

```
Run time (seconds)    =      1.44
Number of iterations  =         7
Log likelihood        = -258.07785
Deviance              =   516.1557
```

weight	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	3.494518	.1372489	25.46	0.000	3.225515	3.76352
age	7.704002	.2394275	32.18	0.000	7.234733	8.173271
age2	-1.660475	.0885319	-18.76	0.000	-1.833994	-1.486955

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:				
sd(cons)	.6356135	.1111122	.3565977	.8251346
cov(cons,age)	.088273	.0812774	-.0710279	.2475738
sd(age)	.50397	.0851741	.2927835	.6498071
Level 1:				
sd(cons)	.5758828	.0462166	.4767712	.6602812

C:\Users\gl9158\Documents

CAP NUM OVR

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

```
. runmlwin, correlation

MLwiN 2.23 multilevel model                       Number of obs      =       198
Normal response model
Estimation algorithm: IGLS
```

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
id	68	1	2.9	5

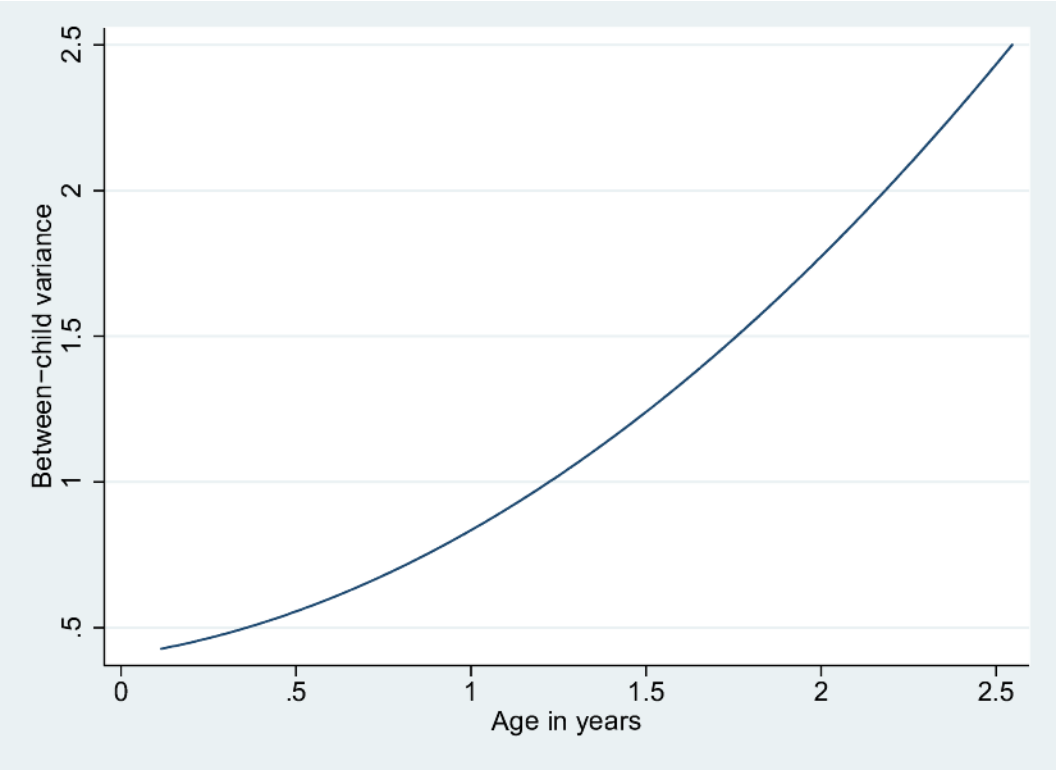
```
Run time (seconds)    =      1.44
Number of iterations  =         7
Log likelihood        = -258.07785
Deviance              =   516.1557
```

weight	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	3.494518	.1372489	25.46	0.000	3.225515	3.76352
age	7.704002	.2394275	32.18	0.000	7.234733	8.173271
age2	-1.660475	.0885319	-18.76	0.000	-1.833994	-1.486955

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:				
var(cons)	.4040045	.1412488	.1271619	.6808471
corr(cons,age)	.2755688	.2964008	-.305366	.8565036
var(age)	.2539857	.0858503	.0857222	.4222493
Level 1:				
var(cons)	.331641	.0532307	.2273107	.4359712

C:\Users\gl9158\Documents

CAP NUM OVR




- ```
  twoway (function [RP2]var(cons) ///
      + 2*[RP2]cov(cons\age)*x ///
      + [RP2]var(age)*x^2, range(age)), ///
      ytitle("Between-child variance")
      xtitle("Age in years")
  ```
  ```

Growth curve model

$$weight_{ij} = \beta_0 + \beta_1 age_{ij} + \beta_2 age_{ij}^2 + u_{0j} + u_{1j} age_{ij} + e_{ij}$$

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

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

```
. runmlwin weight cons age age2, ///
      level2(id: cons age, residuals(u)) ///
      level1(occ: cons) nopause
```

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

Review

	Command	_rc
1	use "http://www.stata-press.co...	
2	graph twoway (connect weight a...	
3	generate cons = 1	
4	generate age2 = age^2	
5	runmlwin weight cons age age2, l...	
6	lincom 1*cons + 2*age + 4*age2	
7	runmlwin weight cons age age2, l...	
8	runmlwin, sd	
9	runmlwin, correlation	
10	twoway (function [RP2]var(cons)...	
11	graph export "Z:\Graph.eps", as(...	
12	runmlwin weight cons age age2, l...	

Variables

Name	Label	Type	Format
id		int	%8.0g
occ		byte	%9.0g
age		float	%8.0g
weight		float	%8.0g
brthwt		int	%8.0g
gender		int	%8.0g
cons		float	%9.0g
age2		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 weight cons age age2, level2(id: cons age, residuals(u)) level1(occ: c
> e

MLwiN 2.23 multilevel model                     Number of obs      =       198
Normal response model
Estimation algorithm: IGLS
```

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
id	68	1	2.9	5

```
Run time (seconds)   =      1.47
Number of iterations =         7
Log likelihood       = -258.07785
Deviance             =   516.1557
```

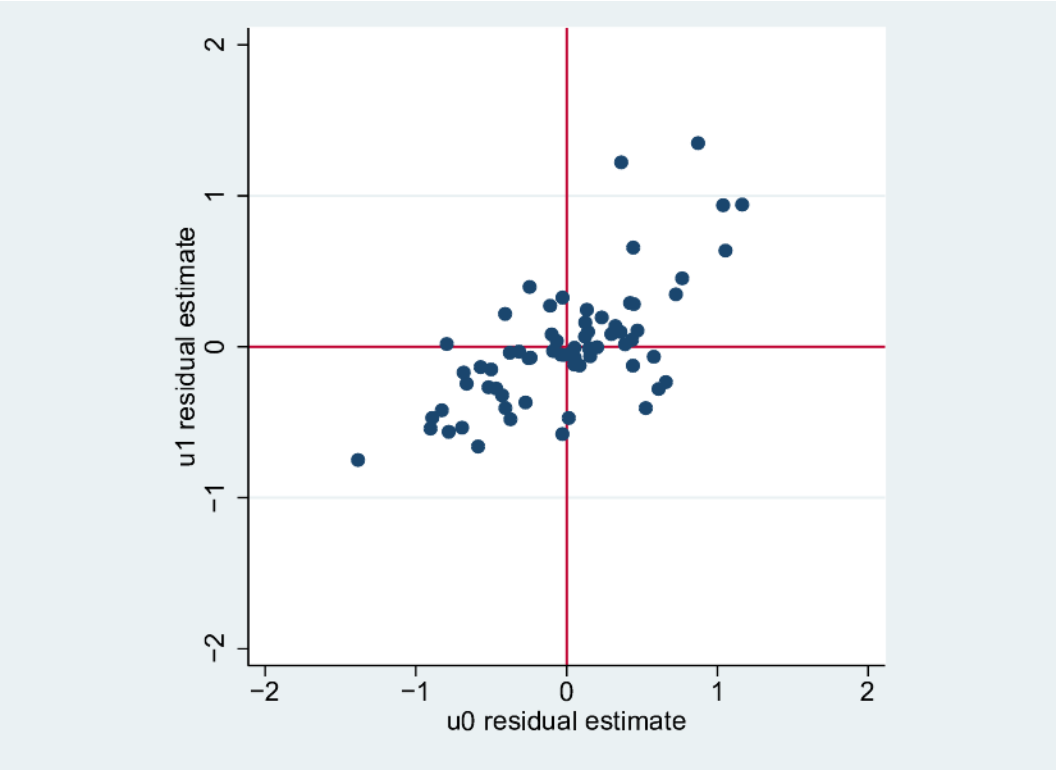
weight	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	3.494518	.1372489	25.46	0.000	3.225515	3.76352
age	7.704002	.2394275	32.18	0.000	7.234733	8.173271
age2	-1.660475	.0885319	-18.76	0.000	-1.833994	-1.486955

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:				
var(cons)	.4040045	.1412488	.1271619	.6808471
cov(cons,age)	.088273	.0812774	-.0710279	.2475738
var(age)	.2539857	.0858503	.0857222	.4222493
Level 1:				
var(cons)	.331641	.0532307	.2273107	.4359712

Command

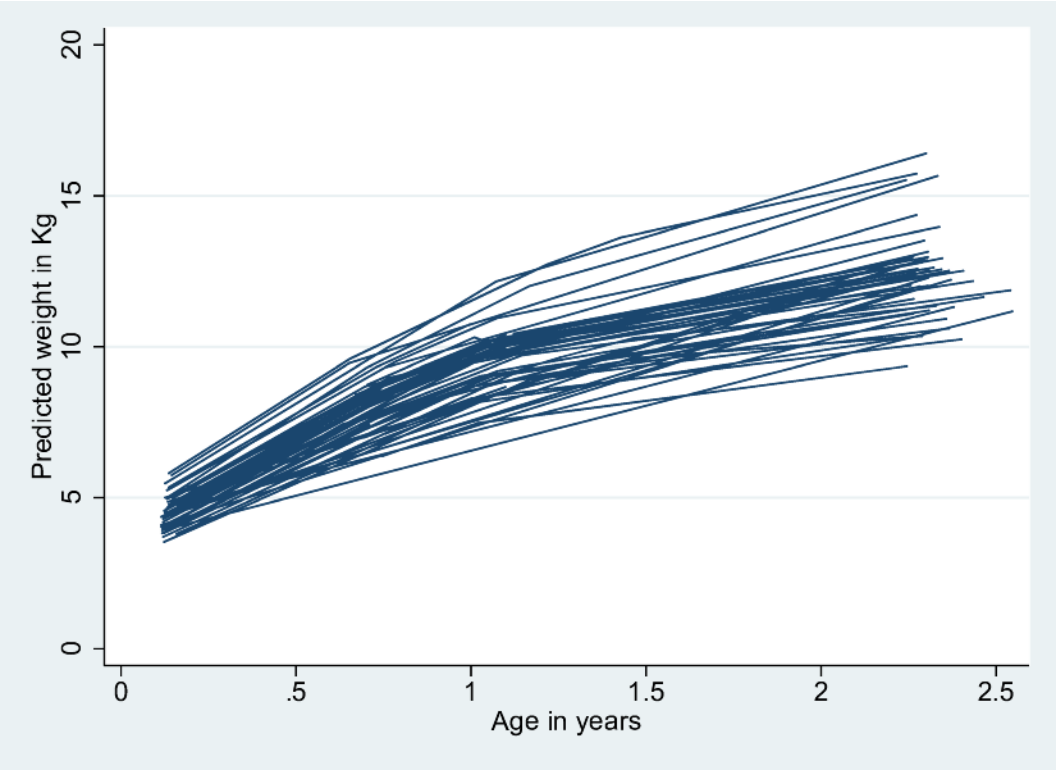
C:\Users\gl9158\Documents

CAP NUM OVR



- `egen pickone = tag(id)`

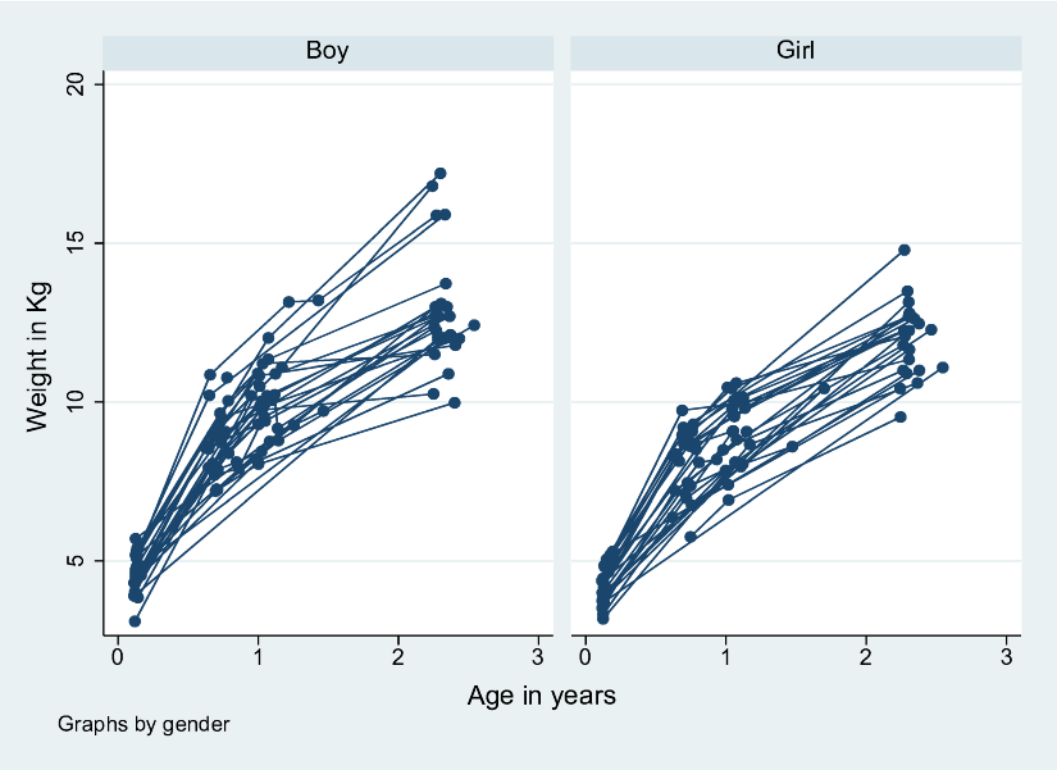
- ```
  scatter u1 u0 if pickone==1, yline(0) xline(0) ///
      aspectratio(1) ylabel(-2(1)2) xlabel(-2(1)2)
  ```
  ```




- ```
  generate prediction = ///
      _b[cons]*cons + _b[age]*age + _b[age2]*age2 ///
      + u0 + u1*age
  ```

- ```
  line prediction age, connect(a) ///
      ytitle("Predicted weight in Kg")
      xtitle("Age in years")
  ```

- ```
  drop u0 u1 prediction
  ```
  ```



- `label define genderlabel 1 "Boy" 2 "Girl"`
- `label values gender genderlabel`
- ```
  graph twoway (connect weight age, ///
      connect(ascending)), by(gender) ///
      ytitle("Weight in Kg") xtitle("Age in years")
  ```
  ```

Add a girl main effect

$$weight_{ij} = \beta_0 + \beta_1 age_{ij} + \beta_2 age_{ij}^2 + \beta_3 girl_j + u_{0j} + u_{1j} age_{ij} + e_{ij}$$

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

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

```
. generate girl = (gender==2)


. runmlwin weight cons age age2 girl, ///
      level2(id: cons age) ///
      level1(occ: cons) nopause
```

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

MLwiN 2.23 multilevel model
Normal response model
Estimation algorithm: **IGLS**

Number of obs = **198**

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
id	**68**	**1**	**2.9**	**5**

Run time (seconds) = **1.47**
Number of iterations = **6**
Log likelihood = **-253.86693**
Deviance = **507.73386**

weight	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	3.794736	.165486	22.93	0.000	3.47039	4.119083
age	7.697968	.238227	32.31	0.000	7.231052	8.164884
age2	-1.65785	.08806	-18.83	0.000	-1.830444	-1.485255
girl	-.5959358	.19634	-3.04	0.002	-.9807551	-.2111165

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:				
var(cons)	.3533458	.1322647	.0941116	.6125799
cov(cons,age)	.0477914	.0803333	-.109659	.2052418
var(age)	.2597153	.0866603	.0898643	.4295663
Level 1:				
var(cons)	.3276618	.0526502	.2244692	.4308544

C:\Users\gl9158\Documents

CAP NUM OVR

Add a girl by age interaction term

$$weight_{ij} = \beta_0 + \beta_1 age_{ij} + \beta_2 age_{ij}^2 + \beta_3 girl_j + \beta_4 girl_j \times age_{ij}$$

$$+u_{0j} + u_{1j} age_{ij} + e_{ij}$$

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

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

```
. generate girlXage = girl*age

. runmlwin weight cons age age2 girl girlXage , ///
      level2(id: cons age) ///
      level1(occ: cons) nopause
```

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

MLwiN 2.23 multilevel model Number of obs = 198
Normal response model
Estimation algorithm: IGLS

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
id	68	1	2.9	5

Run time (seconds) = 1.53
Number of iterations = 6
Log likelihood = -252.99486
Deviance = 505.98972

weight	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	3.748592	.1682112	22.29	0.000	3.418904	4.07828
age	7.814721	.2526623	30.93	0.000	7.319512	8.30993
age2	-1.658581	.0879262	-18.86	0.000	-1.830913	-1.486249
girl	-.5040147	.2071264	-2.43	0.015	-.9099749	-.0980545
girlXage	-.2303164	.1731413	-1.33	0.183	-.5696672	.1090344

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:				
var(cons)	.3464723	.1309956	.0897256	.603219
cov(cons,age)	.0549657	.078705	-.0992932	.2092246
var(age)	.2468243	.0842136	.0817687	.4118799
Level 1:				
var(cons)	.3284454	.0527118	.2251323	.4317585

C:\Users\gl9158\Documents CAP NUM OVR

Allow gender specific residual variances

$$weight_{ij} = \beta_0 + \beta_1 age_{ij} + \beta_2 age_{ij}^2 + \beta_3 girl_j + \beta_4 girl_j \times age_{ij}$$

$$+u_{0j} + u_{1j} age_{ij} + e_{3ij} girl_j + e_{5ij} boy_j$$

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

$$\begin{pmatrix} e_{3ij} \\ e_{5ij} \end{pmatrix} \sim \mathrm{N}\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_{e3}^2 & \\ 0 & \sigma_{e5}^2 \end{pmatrix} \right\}$$

```
. generate boy = 1 - girl

. runmlwin weight cons age age2 girl girlXage , ///
      level2(id: cons age) ///
      level1(occ: girl boy) nopause
```

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

Estimation algorithm: **IGLS**

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
id	**68**	**1**	**2.9**	**5**

Run time (seconds) = 1.58
Number of iterations = 8
Log likelihood = -251.55885
Deviance = 503.11771

weight	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	3.768715	.178281	21.14	0.000	3.41929	4.118139
age	7.755619	.2505671	30.95	0.000	7.264517	8.246721
age2	-1.636874	.0859184	-19.05	0.000	-1.805271	-1.468477
girl	-.5090014	.2124869	-2.40	0.017	-.9254682	-.0925347
girlXage	-.2208346	.1680837	-1.31	0.189	-.5502726	.1086033

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:				
var(cons)	.3868839	.1341005	.1240517	.649716
cov(cons,age)	.0525628	.0759471	-.0962907	.2014164
var(age)	.2218493	.0771886	.0705624	.3731362
Level 1:				
var(girl)	.2456807	.0547544	.138364	.3529974
var(boy)	.4098192	.0839725	.2452362	.5744021

C:\Users\gl9158\Documents

CAP NUM OVR

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

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

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

           chi2(  1) =    3.00
         Prob > chi2 =    0.0833
```

C:\Users\gl9158\Documents

CAP NUM OVR

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

```
. lrtest m1 m2

Likelihood-ratio test                                 LR chi2(1)  =      2.87
(Assumption: m1 nested in m2)                         Prob > chi2 =    0.0901

.
end of do-file

.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
```

C:\Users\gl9158\Documents CAP NUM OVR

Growth curve model by gender

$$weight_{ij} = \beta_0 boy_j + \beta_1 boy_j \times age_{ij} + \beta_2 girl_j + \beta_3 girl_j \times age_{ij} + \beta_4 age_{ij}^2$$

$$+u_{0j} boy_j + u_{1j} boy_j \times age_{ij} + u_{2j} girl_j + u_{3j} girl_j \times age_{ij} + e_{0ij} boy_j + e_{2ij} girl_j$$

$$\begin{pmatrix} u_{0j} \\ u_{1j} \\ u_{2j} \\ u_{3j} \end{pmatrix} \sim \mathrm{N}\left\{ \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_{u0}^2 & & & \\ \sigma_{u01} & \sigma_{u1}^2 & & \\ 0 & 0 & \sigma_{u2}^2 & \\ 0 & 0 & \sigma_{u23} & \sigma_{u3}^2 \end{pmatrix} \right\}$$

$$\begin{pmatrix} e_{0ij} \\ e_{2ij} \end{pmatrix} \sim \mathrm{N}\left\{ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_{e0}^2 & \\ 0 & \sigma_{e2}^2 \end{pmatrix} \right\}$$

```
. matrix a = (1,1,1,0,0,1,0,0,1,1)

. runmlwin weight boy boyXage girl girlXage age2, ///
      level2(id: boy boyXage girl girlXage, elements(a)) ///
      level1(occ: boy girl, diagonal) nopause
```

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/asian.dta - [Results]

File Edit Data Graphics Statistics User Window Help

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
id	68	1	2.9	5

Run time (seconds) = 1.64
Number of iterations = 7
Log likelihood = -247.49434
Deviance = 494.98868

weight	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
boy	3.78267	.1563113	24.20	0.000	3.476305	4.089034
boyXage	7.728288	.2567359	30.10	0.000	7.225095	8.231481
girl	3.266411	.1796806	18.18	0.000	2.914244	3.618579
girlXage	7.502467	.2341932	32.04	0.000	7.043457	7.961477
age2	-1.624745	.0849193	-19.13	0.000	-1.791184	-1.458306

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
Level 2:				
var(boy)	.1553577	.1659469	-.1698922	.4806076
cov(boy,boyXage)	.102065	.1232655	-.1395309	.3436609
var(boyXage)	.3869624	.1692804	.055179	.7187458
var(girl)	.5685636	.2111509	.1547155	.9824117
cov(girl,girlXage)	.0161196	.0864426	-.1533048	.185544
var(girlXage)	.0799457	.0608557	-.0393292	.1992206
Level 1:				
var(boy)	.4182827	.0929099	.2361826	.6003828
var(girl)	.2429176	.0555108	.1341183	.3517168

C:\Users\gl9158\Documents

CAP NUM OVR

2. MULTILEVEL MODELS FOR BINARY RESPONSES

Guatemalan immunization campaign

- Child immunization data
- 2159 children within 1595 mothers within 161 communities
- First analysed by Pebley, Goldman and Rodriguez (1996) and Rodriguez and Goldman (2001)
- Reanalysed by Rabe-Hesketh and Skrondal (2008) and others

Three-level binary response model

$$immun_{ijk} \sim \text{Binomial}(1, \pi_{ijk})$$

$$logit(\pi_{ijk}) = \beta_0 + \beta_1 kid2p_{ijk} + \beta_2 rural_k + \beta_3 pcInd81_k + v_k + u_{jk}$$

$$v_k \sim \text{N}(0, \sigma_u^2)$$

$$u_{jk} \sim \text{N}(0, \sigma_u^2)$$

```
. runmlwin immun cons kid2p rural pcInd81, ///
      level3(cluster: cons) ///
      level2(mom: cons) ///
      level1(kid:) ///
      discrete(dist(binomial) link(logit) denom(cons)) ///
      nopause
```

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/guatemala.dta - [Results]

File Edit Data Graphics Statistics User Window Help

MLwiN 2.23 multilevel model Number of obs = 2159
Binomial logit response model
Estimation algorithm: **IGLS, MQL1**

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
cluster	161	1	13.4	55
mom	1595	1	1.4	3

Run time (seconds) = 2.89
Number of iterations = 5

immun	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	-.1433676	.1721252	-0.83	0.405	-.4807268	.1939915
kid2p	.9173057	.1179051	7.78	0.000	.6862159	1.148395
rural	-.5668908	.1480174	-3.83	0.000	-.8569995	-.276782
pcInd81	-.8460267	.1797028	-4.71	0.000	-1.198238	-.4938157

Random-effects Parameters		Estimate	Std. Err.	[95% Conf.	Interval]
Level 3:	var(cons)	.2960818	.0772351	.1447038	.4474597
Level 2:	var(cons)	.3674519	.1286113	.1153784	.6195254

C:\Users\gl9158\Documents CAP NUM OVR

Refit the model using PQL2

$$immunized_{ijk} \sim \text{Binomial}(1, \pi_{ijk})$$

$$logit(\pi_{ijk}) = \beta_0 + \beta_1 kid2p_{ijk} + \beta_2 rural_k + \beta_3 pcInd81_k + v_k + u_{jk}$$

$$v_k \sim \text{N}(0, \sigma_u^2)$$

$$u_{jk} \sim \text{N}(0, \sigma_u^2)$$

```
. runmlwin immun cons kid2p rural pcInd81, ///
      level3(cluster: cons) ///
      level2(mom: cons) ///
      level1(kid:) ///
      discrete(d(binomial) l(logit) de(cons) pql2) ///
      initsprevious maxiterations(40) nopause
```

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/guatemala.dta - [Results]

File Edit Data Graphics Statistics User Window Help

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

MLwiN 2.23 multilevel model Number of obs = 2159
Binomial logit response model
Estimation algorithm: **IGLS, PQL2**

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
cluster	161	1	13.4	55
mom	1595	1	1.4	3

Run time (seconds) = 8.71
Number of iterations = 29

immun	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
cons	-.1897211	.2437707	-0.78	0.436	-.6675029	.2880607
kid2p	1.363391	.1542231	8.84	0.000	1.061119	1.665663
rural	-.8506848	.2157692	-3.94	0.000	-1.273585	-.427785
pcInd81	-1.313231	.2638969	-4.98	0.000	-1.83046	-.7960028

Random-effects Parameters		Estimate	Std. Err.	[95% Conf.	Interval]
Level 3:	var(cons)	.6723186	.1658299	.3472979	.9973393
Level 2:	var(cons)	2.352684	.2589447	1.845162	2.860206

C:\Users\gl9158\Documents CAP NUM OVR

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/guatemala.dta - [Results]

File Edit Data Graphics Statistics User Window Help

```
. estimates table mql1 pql2
```

Variable	mql1	pql2
FP1		
cons	-.14336765	-.18972108
kid2p	.91730571	1.3633909
rural	-.56689078	-.85068482
pcInd81	-.84602666	-1.3132312
RP3		
var(cons)	.29608175	.67231864
RP2		
var(cons)	.36745191	2.352684
RP1		
var(bcons_1)	1	1

C:\Users\gl9158\Documents

CAP NUM OVR

3. SIMULATION STUDIES ARE EASY

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 = 1/10 {
    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: 1, Col: 0 CAP NUM OVR

4. MCMC ESTIMATION

Refit the model using MCMC

$$immun_{ijk} \sim \text{Binomial}(1, \pi_{ijk})$$

$$logit(\pi_{ijk}) = \beta_0 + \beta_1 kid2p_{ijk} + \beta_2 rural_k + \beta_3 pcInd81_k + v_k + u_{jk}$$

$$v_k \sim \text{N}(0, \sigma_u^2)$$

$$u_{jk} \sim \text{N}(0, \sigma_u^2)$$

```
. runmlwin immun cons kid2p rural pcInd81, ///
      level3(cluster: cons) ///
      level2(mom: cons) ///
      level1(kid:) ///
      discrete(d(binomial) l(logit) de(cons)) ///
      mcmc(on) initsprevious nopause
```

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
cluster	**161**	**1**	**13.4**	**55**
mom	**1595**	**1**	**1.4**	**3**

Burnin	=	500
Chain	=	5000
Run time (seconds)	=	30
Deviance (dbar)	=	1619.22
Deviance (thetabar)	=	866.88
Effective no. of pars (pd)	=	752.34
Bayesian DIC	=	2371.56

immun	Mean	Std. Dev.	z	ESS	[95% Cred.	Interval]
cons	-.2200957	.3358961	-0.66	42	-.889235	.5050995
kid2p	1.754326	.2300542	7.63	53	1.3257	2.208608
rural	-1.145384	.2759653	-4.15	56	-1.6628	-.6193233
pcInd81	-1.709476	.3672927	-4.65	61	-2.520294	-1.065675

Random-effects Parameters		Mean	Std. Dev.	ESS	[95% Cred.	Int]
Level 3:	var(cons)	**1.161717**	**.3641234**	**81**	**.6004681**	**2.046271**
Level 2:	var(cons)	**5.934905**	**1.221375**	**21**	**3.805253**	**8.552722**

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/guatemala.dta - [Results]

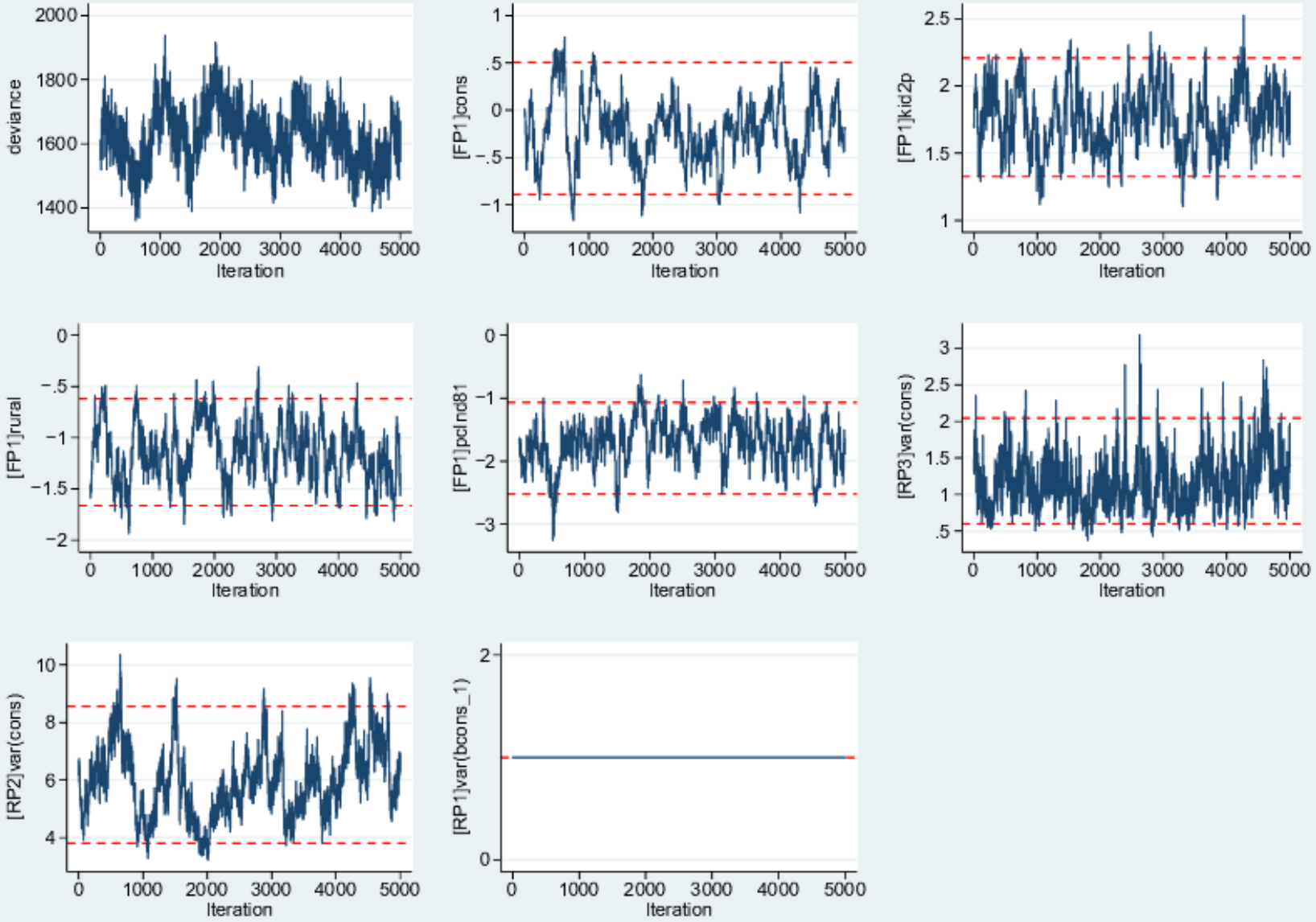
File Edit Data Graphics Statistics User Window Help

```
. estimates table mql1 pql2 mcmc
```

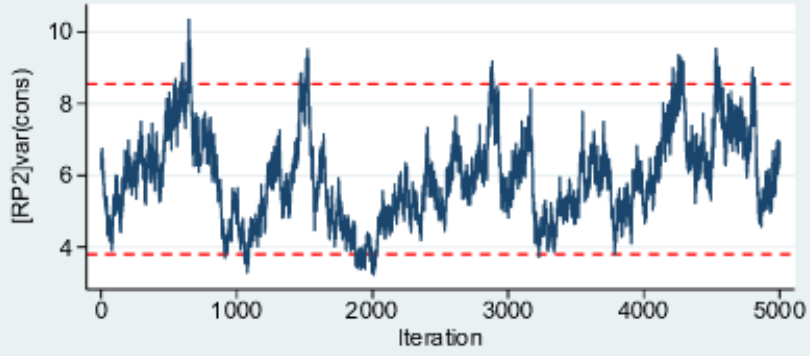
Variable	mql1	pql2	mcmc
FP1			
cons	-.14336765	-.18972108	-.22009568
kid2p	.91730571	1.3633909	1.754326
rural	-.56689078	-.85068482	-1.1453843
pcInd81	-.84602666	-1.3132312	-1.7094761
RP3			
var(cons)	.29608175	.67231864	1.1617173
RP2			
var(cons)	.36745191	2.352684	5.9349046
RP1			
var(bcons_1)	1	1	1

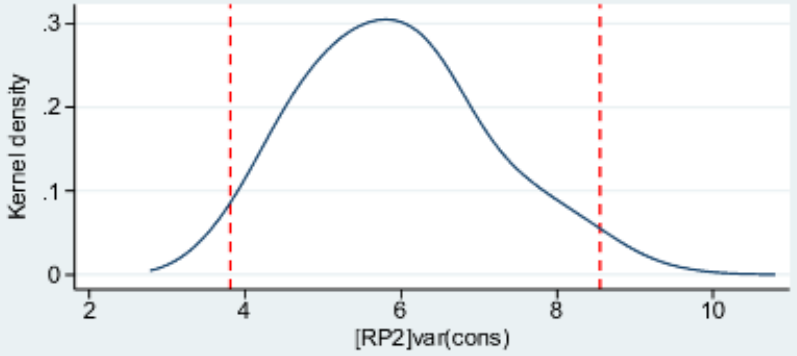
C:\Users\gl9158\Documents

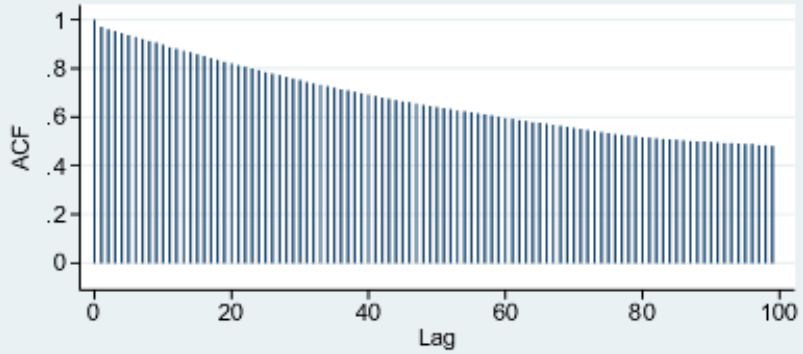
CAP NUM OVR

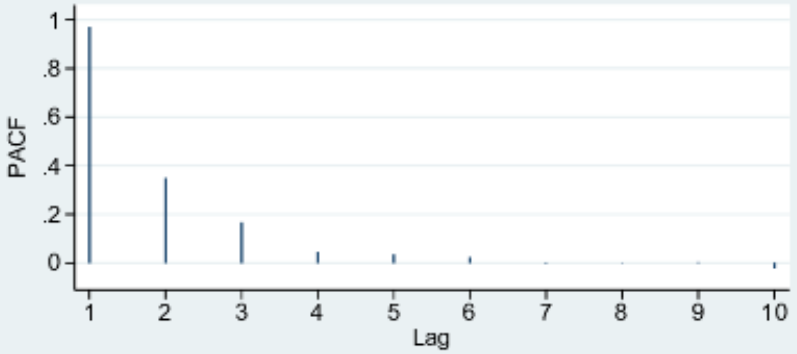


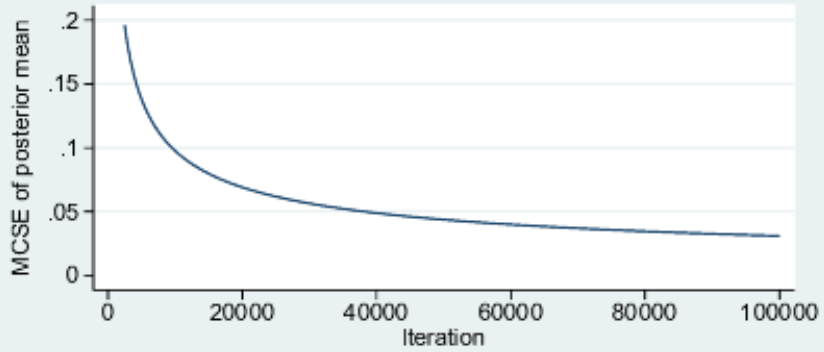

```
. mcmcsum, trajectories
```












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

Stata/MP 11.2 - http://www.bristol.ac.uk/cmm/media/runmlwin/tutorial.dta - [Results]

File Edit Data Graphics Statistics User Window Help

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

                        [RP2]var(standlrt)
------------------------------------------------------------------------------

                                  Percentiles
Mean              .0862781    0.5%   .0193246   Thinned Chain Length      5000
MCSE of Mean      .0024099    2.5%   .0243268   Effective Sample Size       99
Std. Dev.         .0467082      5%   .0298808   Raftery Lewis (2.5%)     25770
Mode              .0631075     25%   .0520173   Raftery Lewis (97.5%)    23976
                                                Brooks Draper (mean)     446390
                                50%   .0765091
                                75%   .1100566
                                95%    .179421
                              97.5%   .2023509
                              99.5%   .2549108
------------------------------------------------------------------------------

.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
.
```

C:\Users\gl9158\Documents

CAP NUM OVR

Run the model for longer

$$immunized_{ijk} \sim \text{Binomial}(1, \pi_{ijk})$$

$$logit(\pi_{ijk}) = \beta_0 + \beta_1 kid2p_{ijk} + \beta_2 rural_k + \beta_3 pcInd81_k + v_k + u_{jk}$$

$$v_k \sim \text{N}(0, \sigma_u^2)$$

$$u_{jk} \sim \text{N}(0, \sigma_u^2)$$

```
. runmlwin immunized cons kid2p rural pcInd81, ///
      level3(cluster: cons) ///
      level2(mom: cons) ///
      level1(kid:) ///
      discrete(d(binomial) l(logit) de(cons)) ///
      mcmc(burnin(5000) chain(50000) thinning(10)) ///
      initsprevious nopause
```

Stata/MP 11.2 - http://www.stata-press.com/data/mlmus2/guatemala.dta - [Results]

File Edit Data Graphics Statistics User Window Help

Level Variable	No. of Groups	Observations per Group Minimum	Average	Maximum
cluster	**161**	**1**	**13.4**	**55**
mom	**1595**	**1**	**1.4**	**3**

Burnin	=	5000
Chain	=	50000
Run time (seconds)	=	257
Deviance (dbar)	=	1641.35
Deviance (thetabar)	=	895.18
Effective no. of pars (pd)	=	746.17
Bayesian DIC	=	2387.51

immun	Mean	Std. Dev.	z	ESS	[95% Cred.	Interval]
cons	-.2421288	.3079326	-0.79	424	-.8276453	.3486197
kid2p	1.730911	.2184296	7.92	434	1.335295	2.19006
rural	-1.089141	.2954561	-3.69	471	-1.687306	-.5090104
pcInd81	-1.681882	.369106	-4.56	587	-2.450633	-.9707532

Random-effects Parameters		Mean	Std. Dev.	ESS	[95% Cred.	Int]
Level 3:	var(cons)	1.127521	.3580364	572	.5575184	1.94313
Level 2:	var(cons)	5.628252	1.25813	186	3.587712	8.415654

Q:\C-modelling\runmlwin\presentations\2011-05-26 Connecticut

CAP NUM OVR

5. WORK EFFICIENTLY

Do-file Editor - Bristol_MUGS.do

File Edit Tools View

Bristol_MUGS.do

```
50
51  * Open the data
52  use "http://www.stata-press.com/data/mlmus2/asian.dta", clear
53
54  * Plot child weight against age
55  graph twoway (connect weight age, connect(ascending)), ///
56      ytitle("Weight in Kg") xtitle("Age in years")
57
58  * Generate a variable cons to act as the constant in the models
59  generate cons = 1
60
61  * Generate age squared
62  generate age2 = age^2
63
64  * Fit a two-level random intercepts model to child weight
65  runmlwin weight cons age age2, ///
66      level2(id: cons) ///
67      level1(occ: cons)
68
69  * Calculate the predicted weight of a 2 year-old
70  lincom 1*cons + 2*age + 4*age2
71
72  * Fit a random intercepts and random slopes model to child weight
73  runmlwin weight cons age age2, ///
74      level2(id: cons age) ///
75      level1(occ: cons) nopause
76
77  * Display the variance parameters as standard deviations
78  runmlwin, sd
79
80  * Display the correlation between the random intercepts and random slopes
81  runmlwin, correlation
82
83  * Plot the child-level varaince function
84  twoway (function [RP2]var(cons) + 2*[RP2]cov(cons\age)*x ///
85      + [RP2]var(age)*x^2, range(age)), ///
```

Ready

Line: 1, Col: 0 CAP NUM OVR

6. RESOURCES TO HELP YOU LEARN RUNMLWIN

help runmlwin

Title

runmlwin - Run the MLwiN multilevel modelling software from within Stata

Syntax

runmlwin *responses_and_fixed_part*, *random_part* [discrete(*discrete_options*)] [mcmc(*mcmc_options*)] [*general_options*]

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

for univariate continuous, binary, proportion and count response models

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

for univariate ordered and unordered categorical response models

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

where *indepvars1* are those independent variables which appear with separate coefficients in each of 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. These contrasts are indexed 1,2,... up to the total number of contrasts included in the model. The total number of contrasts will be one less than the number of response categories.

for multivariate response models

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

where **equation(***numlist***)** specifies equation numbers. Equation numbers are indexed 1,2,... up to the total number of equations (i.e. response variables) included in the model.

and the syntax of *random_part* is

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

Examples

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

(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 (fitted using IGLS)
(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 (fitted using IGLS)
(See page 59 of the MLwiN User Manual)

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

Refit the model suppressing the two pauses in MLwiN (fitted using IGLS)
(See page 59 of the MLwiN User Manual)

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

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

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

Two-level random-intercept and random-slope (coefficient) model with a complex level 1 variance function (fitted using IGLS)
(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))
```

Two-level random-intercept and random-slope (coefficient) model using MCMC (where we first fit the model using IGLS to obtain initial values for the MCMC chains)
(See page 71 of the MLwiN MCMC Manual)

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

Multivariate response models

SOFTWARE

- MLwiN
- Realcom
- MLPowSim
- runmlwin
  - Presentations
  - Examples
  - Citations
  - User Forum
- CMM software support

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

runmlwin: Running MLwiN from within Stata

runmlwin is a Stata command which allows Stata users to run the powerful MLwiN multilevel modelling software from within Stata.

The multilevel models fitted by **runmlwin** are often considerably faster than those fitted by the Stata's **xtmixed, xtmelogit** and **xtmepoisson** commands. The range of models which can be fitted by **runmlwin** is also much wider than those commands. **runmlwin** also allows fast estimation on large data sets for many of the more complex multilevel models available through the user written **gllamm** command.

MLwiN has the following features:

1. Estimation of multilevel models for continuous, binary, count, ordered categorical and unordered categorical data
2. Fast estimation via classical and Bayesian methods
3. Estimation of multilevel models for cross-classified and multiple membership nonhierarchical data structures
4. Estimation of multilevel multivariate response models, multilevel spatial models, multilevel measurement error models and multilevel multiple imputation models

These details with a screen shot are available on our **runmlwin** leaflet (pdf, 0.1mb)

Presentations

We have provided a range of presentations showcasing **runmlwin**. These presentations provide a quick overview of how the command works and the range of models which can be fitted. More > >

Download

SOFTWARE

- MLwiN
- Realcom
- MLPowSim
- runmlwin
  - Presentations
  - Examples
  - Citations
  - User Forum
- CMM software support

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

Presentations using runmlwin

- UK Stata Users' Group, 17th Meeting (16th September 2011)
  - Slides (PDF, 2.0mb)
  - Stata do-file (do, 0.1mb) to replicate all analyses presented in the slides.
- University of Bristol, Mplus/MlwiN User Group (MUGS) meeting (14th June 2011)
  - Slides (PDF, 2.3mb)
  - Stata do-file (do, 0.1mb) to replicate all analyses presented in the slides.
- Modern Modeling Methods (M3) Conference, University of Connecticut (26th May 2011)
  - Slides (PDF, 3.2mb)
  - Stata do-file (do, 0.1mb) to replicate all analyses presented in the slides.
- 2011 American Sociological Association Spring Methodology Conference, Tilburg University (20th May 2011)
  - Slides (PDF, 2.0mb)
  - Stata do-file (do, 0.1mb) to replicate all analyses presented in the slides.
- University of Bristol, e-Stat meeting (7th April 2011)
  - Slides (PDF, 1.7mb)
  - Stata do-file (do, 0.1mb) to replicate all analyses presented in the slides.
- 8th International Amsterdam Multilevel Conference (17th March 2011)

SOFTWARE

- MLwiN
- Realcom
- MLPowSim
- runmlwin
  - Presentations
  - Examples
  - Citations
  - User Forum
- CMM software support

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

Examples using runmlwin

MLwiN User Manual

These do-files and log files replicate the analyses reported in the MLwiN User Manual (PDF, 4.6 mb) Rasbash, J., Steele, F., Browne, W.J. and Goldstein, H. (2009) Centre for Multilevel Modelling, University of Bristol.

Note that we have not created do-files for Chapters 1, 8 or 19 of the manual as no models are fitted in those chapters. We have also not yet attempted to replicate the analysis in Chapter 17.

- 1 - Introducing Multilevel Models
- 2 - Introduction to Multilevel Modelling (do | log)
- 3 - Residuals (do | log)
- 4 - Random Intercept and Random Slope Models (do | log)
- 5 - Graphical Procedures for Exploring the Model (do | log)
- 6 - Contextual Effects (do | log)
- 7 - Modelling the Variance as a Function of Explanatory Variables (do | log)
- 8 - Getting Started with your Data
- 9 - Logistic Models for Binary and Binomial Responses (do | log)
- 10 - Multinomial Logistic Models for Unordered Categorical Responses (do | log)
- 11 - Fitting an Ordered Category Response Model (do | log)
- 12 - Modelling Count Data (do | log)
- 13 - Fitting Models to Repeated Measures Data (do | log)
- 14 - Multivariate Response Models (do | log)

CMM software support

- Rasbash, J., Charlton, C., Browne, W.J., Healy, M. and Cameron, B. 2009. MLwiN Version 2.1. Centre for Multilevel Modelling, University of Bristol.

For models fitted using MCMC estimation, we ask that you additionally cite:

- Browne, W.J. 2009. MCMC Estimation in MLwiN, v2.13. Centre for Multilevel Modelling, University of Bristol.

Papers using runmlwin

Please let George Leckie (g.leckie@bristol.ac.uk) know of any further publications using **runmlwin** including forthcoming papers, books, PhD theses, etc.

- Cheung, C., Goodman, D., Leckie, G. and Jenkins, J. (2011) Understanding Contextual Effects on Externalizing Behaviors in Children in Out-of-home Care: Influence of Workers and Foster Families. *Children and Youth Services Review,* 33, 2050-2060.

- Chung, H. and Beretvas, S.N. (2011) The Impact of ignoring multiple membership data structures in multilevel models. *British Journal of Mathematical and Statistical Psychology. Forthcoming.*

- Leckie, G. and Baird, J.-A. (2011) Rater effects on essay scoring: A multilevel analysis of severity drift, central tendency and rater experience. *Journal of Educational Measurement. Forthcoming.*

- Leckie, G., Pillinger, R., Jones, K. and Goldstein, H. (2011) Multilevel modelling of social segregation. *Journal of Educational and Behavioral Statistics. Forthcoming.*

- Paternoster, L., Howe, L. D., Tilling, K., Weedon, M. N., Freathy, R. M., Frayling, T. M., Kemp, J. P., Davey Smith, G., Timpson, N. J. Ring, S. M., Evans, D. M. and Lawlor, D. A. (2011) Adult height variants affect birth length and growth rate in children. *Human Molecular Genetics. Forthcoming*

Books discussing runmlwin

- Snijders, T. and Bosker, R. (2011) Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling, Second Edition. *Sage. Forthcoming.*

runmlwin user forum

Forum rules

NEWTOPIC* Search this forum... Search

20 topics • Page 1 of 1

ANNOUNCEMENTS	REPLIES	VIEWS	LAST POST
Do-files to replicate entire MLwiN User & MCMC Manuals by GeorgeLeckie » Mon Apr 18, 2011 5:30 pm	0	123	by GeorgeLeckie Mon Apr 18, 2011 5:30 pm
Welcome to the runmlwin discussion forum by GeorgeLeckie » Fri Apr 01, 2011 4:06 pm	0	130	by GeorgeLeckie Fri Apr 01, 2011 4:06 pm

TOPICS	REPLIES	VIEWS	LAST POST
MVs & error message 'line too long' by julia1633 » Mon Aug 15, 2011 3:17 pm 1 2	17	125	by julia1633 Sun Aug 28, 2011 12:05 am
runmlwin in Batch mode - gui causing error? by ash » Sat Aug 27, 2011 6:43 am	2	20	by ash Sat Aug 27, 2011 9:07 pm
Bug in residuals(u, savechains("u.dta", replace)) ? by ash » Mon Aug 01, 2011 7:06 pm	4	76	by GeorgeLeckie Wed Aug 03, 2011 6:25 pm
Predictions via the runmlwin interface: a clarification by ewancarr » Tue Jul 26, 2011 6:49 pm	6	84	by GeorgeLeckie Wed Jul 27, 2011 7:04 pm
highly correlated multivariate depenents -> numerical error by ash » Sat Jul 23, 2011 10:48 am	1	67	by GeorgeLeckie Mon Jul 25, 2011 3:49 pm
Input dataset contains double precision data... by ewancarr » Wed Jul 13, 2011 3:55 pm	2	81	by ewancarr Wed Jul 13, 2011 9:16 pm
Modelling Count Data (example do-file) - mismatch error by leap » Tue Jul 12, 2011 10:18 am	1	48	by ChrisCharlton Wed Jul 13, 2011 3:32 pm
Error code: r(-1073740777); by pd65 » Mon Jul 04, 2011 11:01 am	7	207	by GeorgeLeckie Thu Jul 07, 2011 3:15 pm
MCMC estimation by ianna » Fri Apr 08, 2011 9:20 am	5	293	by ChrisCharlton Thu Jun 09, 2011 10:09 am

Citing `runmlwin`

- If you use `runmlwin` in your work, please cite `runmlwin`
- Leckie, G. and Charlton, C. (2011) *runmlwin: Stata module for fitting multilevel models in the MLwiN software package*. Centre for Multilevel Modelling, University of Bristol.
- We can then add you to the list of papers using `runmlwin` on our website
- http://www.bristol.ac.uk/cmm/software/runmlwin/citations