HCM2 model for the Scotland data

1. Description of the model

In this example we fit a third model to the data from a study of neighborhood and school effects on educational attainment in Scotland (Garner & Raudenbush, 1991). In the previous model, the relationship between social deprivation and attainment was assumed invariant across schools. Now we test the tenability of this assumption.

2. Creating the command file

From the WHLM window, open the **File** menu. Choose **Edit/Run old command (.hlm/.mlm) file** to open an **Open Command File** dialog box. Open the command file for the unconditional model (ATTAIN2.HLM in our example).
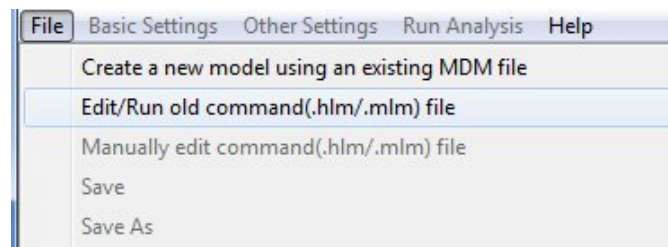
To specify the effect of the row-specific predictor random, select the equation containing π_0. Click on c_{01}. The conditional model with the social deprivation effect specified as random is shown below.

WHLM: hcm2 MDM File: ATTAIN.MDM

File   Basic Settings   Other Settings   Run Analysis   Help

Outcome
Level-1
>> Row <<
Column

ICPTROW
DEPRIVE

LEVEL 1 MODEL (bold italic: grand-mean centering)

$$ATTAIN = \pi_0 + \pi_1(P7VRQ) + \pi_2(P7READ) + \pi_3(DADOCC) + \pi_4(DADUNEMP)$$
$$+ \pi_5(DADED) + \pi_6(MOMED) + \pi_7(MALE) + e$$

LEVEL 2 MODEL (bold italic: grand-mean centering)

$$\pi_0 = \theta_0 + b_{00} + c_{00}$$
$$+ (\gamma_{01} + c_{01})DEPRIVE$$

$$\pi_1 = \theta_1 + b_{10} + c_{10}$$
$$\pi_2 = \theta_2 + b_{20} + c_{20}$$
$$\pi_3 = \theta_3 + b_{30} + c_{30}$$
$$\pi_4 = \theta_4 + b_{40} + c_{40}$$
$$\pi_5 = \theta_5 + b_{50} + c_{50}$$
$$\pi_6 = \theta_6 + b_{60} + c_{60}$$
$$\pi_7 = \theta_7 + b_{70} + c_{70}$$

Mixed ▼

We compare the model deviance of this model against the one estimated in the last analysis. This is done by selecting the **Other Settings, Hypothesis Testing** option from the main menu bar and entering the deviance and number of parameters for the previous model to the appropriate fields.

Hypothesis Testing - HCM2

Multivariate Hypothesis Tests

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |

Test against another model

Deviance   4769.604659

Number of Parameters   12

OK

Cancel

Click **OK** to return to the main window and remember to save the model before running the analysis.

3. Interpreting the output

The results of the analysis are given below.

$\sigma^2 = 0.45519$

τ_{rows}
INTRCPT1
ICPTROW,b_{00j}
  0.00371

$\tau_{columns}$

INTRCPT1	INTRCPT1
ICPTCOL,c_{00k}	DEPRIVE,c_{01k}
0.00391	0.00159
0.00159	0.00067

The point estimate of the variance of the unique contribution of school k to the association between social deprivation and attainment is .001 and that of the covariance between the effect with the school random effect is .002.

$\tau_{columns}$ (as correlations)

INTRCPT1/ ICPTCOL,c_{00k}	1.000	0.984
INTRCPT1/ DEPRIVE,c_{01k}	0.984	1.000

The value of the log-likelihood function at iteration 865 = -2.384254E+003

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard error	t-ratio	Approx. d.f.	p-value
For INTRCPT1, π_0					
INTERCEPT,θ_0	0.092434	0.021354	4.329	1752	<0.001
DEPRIVE, γ_{01}	-0.159051	0.026763	-5.943	522	<0.001
For P7VRQ, π_1					
INTERCEPT,θ_1	0.027636	0.002263	12.211	1752	<0.001
For P7READ, π_2					
INTERCEPT,θ_2	0.026242	0.001750	14.992	1752	<0.001
For DADOCC, π_3					
INTERCEPT,θ_3	0.008112	0.001360	5.964	1752	<0.001
For DADUNEMP, π_4					
INTERCEPT,θ_4	-0.120306	0.046759	-2.573	1752	0.010
For DADED, π_5					
INTERCEPT,θ_5	0.142622	0.040753	3.500	1752	<0.001
For MOMED, π_6					
INTERCEPT,θ_6	0.060870	0.037358	1.629	1752	0.103
For MALE, π_7					
INTERCEPT,θ_7	-0.056139	0.028383	-1.978	1752	0.048

Final estimation of row and level-1 variance components:

Random Effect	Standard Deviation	Variance Component	d.f.	χ^2	p-value
INTRCPT1/ ICPTROW,b_{00j}	0.06087	0.00371	522	545.30137	0.232
level-1, e	0.67468	0.45519			

Final estimation of column level variance components:

Random Effect	Standard Deviation	Variance Component	d.f.	χ^2	p-value
INTRCPT1/ ICPTCOL,c_{00k}	0.06255	0.00391	15	32.32912	0.006
INTRCPT1/ DEPRIVE,c_{01k}	0.02582	0.00067	15	9.67718	>0.500

Statistics for the current model

Deviance = 4768.508277
Number of estimated parameters = 14

Model comparison test

χ^2 statistic = 1.09638
Degrees of freedom = 2
p-value = >.500

The result of the deviance test is not significant. There is no evidence that the association between neighborhood social deprivation and attainment varies over schools. Not surprisingly, the standard error for $\hat{\gamma}_{01}$, the social deprivation effect, remains nearly unchanged, as do all inferences about the fixed effects.