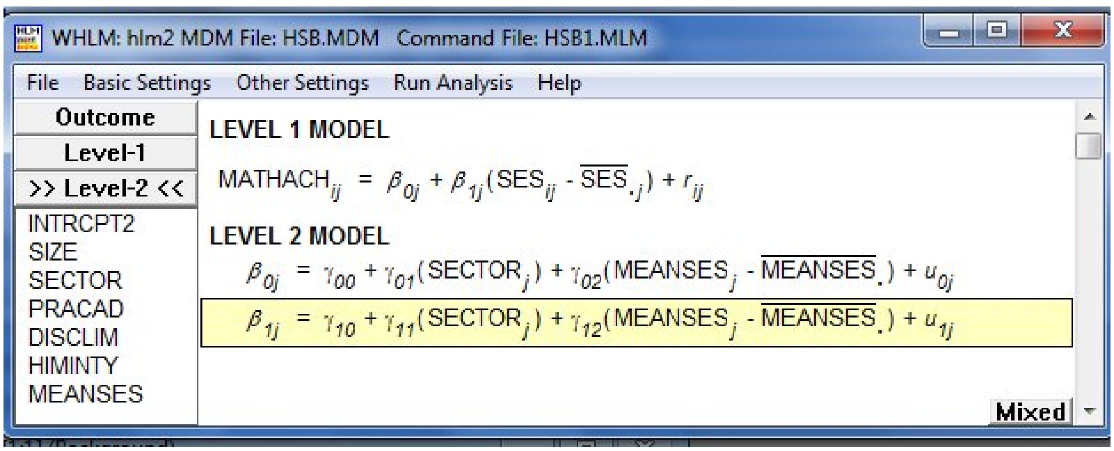
Scientific Software International

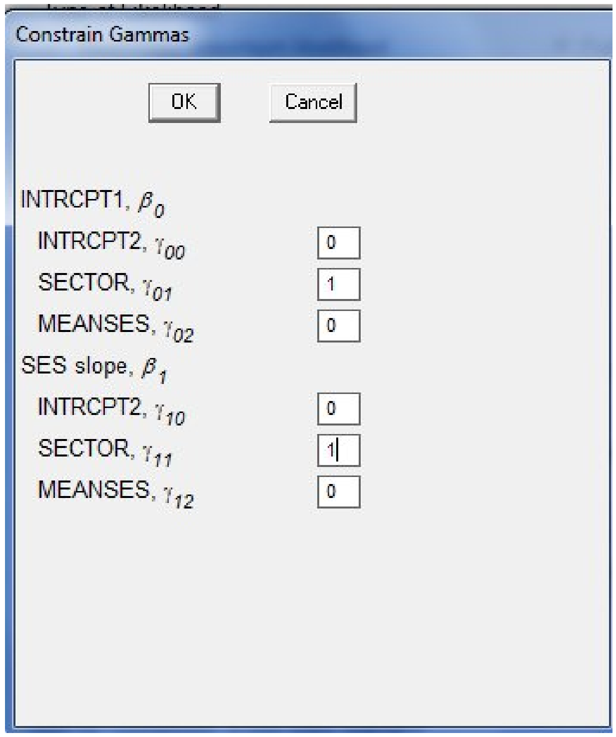
Constraining fixed effects to be equal

A user may wish to constrain two or more fixed effects to be equal. For example, we may want to test that the coefficients associated with the level-2 predictor SECTOR are equal in the model



In other words, we want to set $H_0 : \gamma_{01} = \gamma_{11}$ against the alternative $H_0 : \gamma_{01} \neq \gamma_{11}$.

To do this, start by opening the **Other Settings** menu and selecting the **Estimation Settings** option to open the **Estimation Settings – HLM2** dialog box. Next, click on the Constrain fixed effects button to open the **Constrain Gammas** dialog box and set γ_{01} and γ_{11} equal to 1.



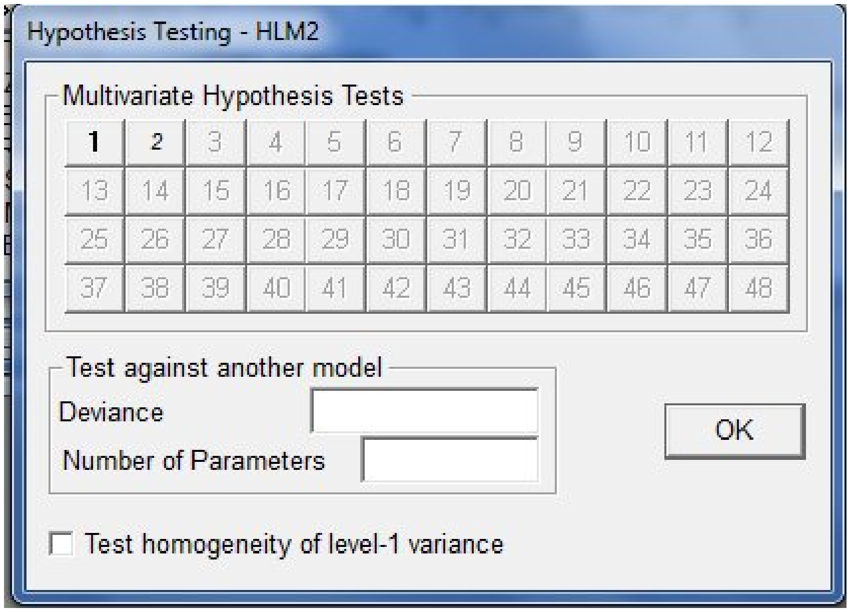
The output obtained for this model (see below) shows the result: a single common estimate is provided form the predictor SECTOR.

Final estimation of fixed effects
(with robust standard errors)

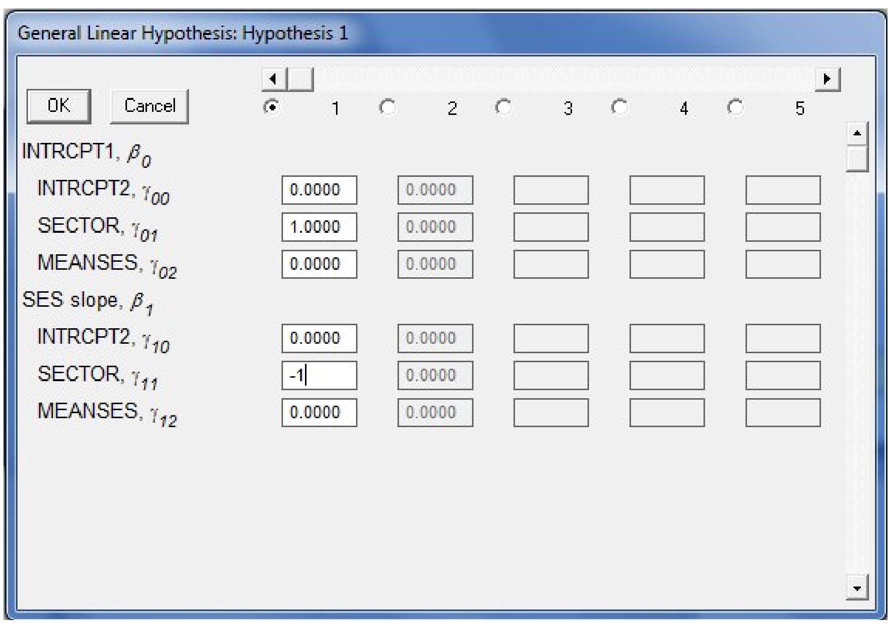
Fixed Effect	Coefficient	Standard error	t-ratio	Approx. d.f.	p-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	12.893983	0.174318	73.968	157	<0.001
SECTOR, γ_{01}*	-0.557407	0.184857	-3.015	157	0.003
MEANSES, γ_{02}	6.111559	0.332276	18.393	157	<0.001
For SES slope, β_1					
INTRCPT2, γ_{10}	2.447020	0.146255	16.731	158	<0.001
MEANSES, γ_{12}	0.544891	0.345942	1.575	158	0.117

The "*" gammas have been constrained.

To test whether this is realistic, the **Hypothesis Testing** dialog box may be used instead. This dialog box is accessed via the **Other Settings**, **Hypothesis Testing** option.



A test is set up via the **Multivariate Hypothesis Tests** field as shown below. This corresponds to the hypothesis $H_0 : \gamma_{01} - \gamma_{11} = 0$.



After running the model, the following results are printed to the output file:

Results of General Linear Hypothesis Testing - Test 1

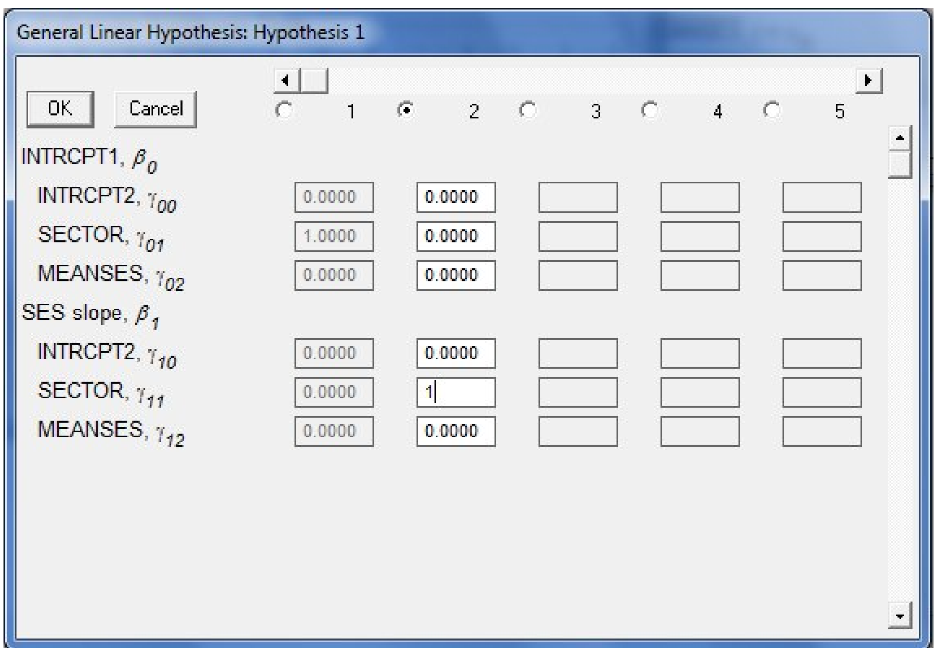
	Coefficients	Contrast
For INTRCPT1, β_0		
INTRCPT2, γ_{00}	12.083837	0.0000
SECTOR, γ_{01}	1.280341	1.0000
MEANSES, γ_{02}	5.163791	0.0000

For SES slope, β_1		
INTRCPT2, γ_{10}	2.935664	0.0000
SECTOR, γ_{11}	-1.642102	-1.0000
MEANSES, γ_{12}	1.044120	0.0000
Estimate		2.9224
Standard error of estimate		0.3918

χ^2 statistic = 55.632927
Degrees of freedom = 1
p-value = <0.001

The chi-square and associated p-value indicate that it is highly unlikely that observed estimates for γ_{01} and γ_{11} could have occurred under the specified null hypothesis.

Alternatively, it may be of interest to test whether γ_{01} and γ_{11} are significantly different from zero. The null hypothesis $H_0 : \gamma_{01} = \gamma_{11} = 0$ may be tested by setting up the **General Linear Hypothesis** dialog box as shown below:



For this case, the following output is obtained:

Results of General Linear Hypothesis Testing - Test 1

	Coefficients	Contrast	
For INTRCPT1, β_0			
INTRCPT2, γ_{00}	12.095005	0.0000	0.0000
SECTOR, γ_{01}	1.226775	1.0000	0.0000
MEANSES, γ_{02}	5.331626	0.0000	0.0000
For SES slope, β_1			
INTRCPT2, γ_{10}	2.939314	0.0000	0.0000
SECTOR, γ_{11}	-1.644087	0.0000	1.0000
MEANSES, γ_{12}	1.042828	0.0000	0.0000

Estimate	1.2268	-1.6441
Standard error of estimate	0.3033	0.2371

χ^2 statistic = 69.255618
Degrees of freedom = 2
p-value = <0.001

The chi-square and associated p-value indicate that it is highly unlikely that observed estimates for γ_{01} and γ_{11} could have occurred under the specified null hypothesis.