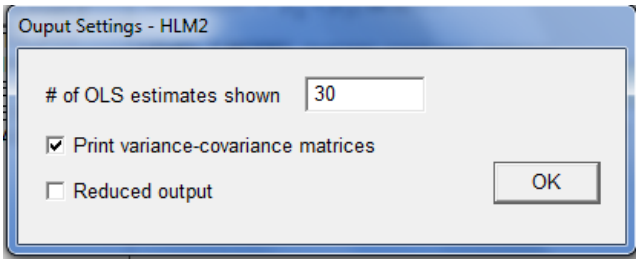
Output options and additional output files in HLM

Output option in standard output file

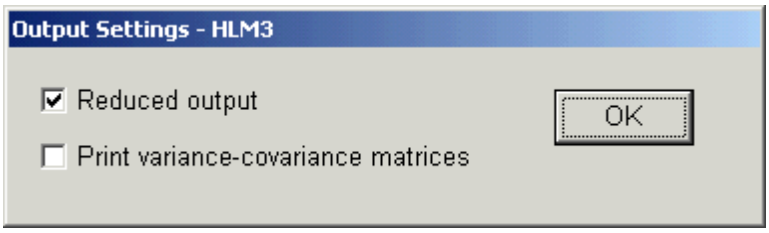
Some of the HLM modules allow the user to manipulate the amount of information printed to the standard output file. This is done by selecting the **Output Settings** option from the **Other Settings** menu to bring up the **Output Settings** dialog box and then checking or unchecking the **Reduced output** option on the **Output Settings** dialog box.



- In HLM2, HLM3 and HLM4 selection of the **Reduced output** option on the **Output Settings** dialog box will suppress the printing of the Least Squares and Starting Values results.
- In HLM2, the user can also request printing of the OLS results by level-2 unit by specifying the number of units for which results should be printed to file on the **Output Settings** dialog box.
- In HMLM, HMLM2, HCM2 and HLMHCM unchecking the **Reduced output** option allows the printing of starting values for variance-covariance matrices and detail of the last few iterations before convergence to the output file.

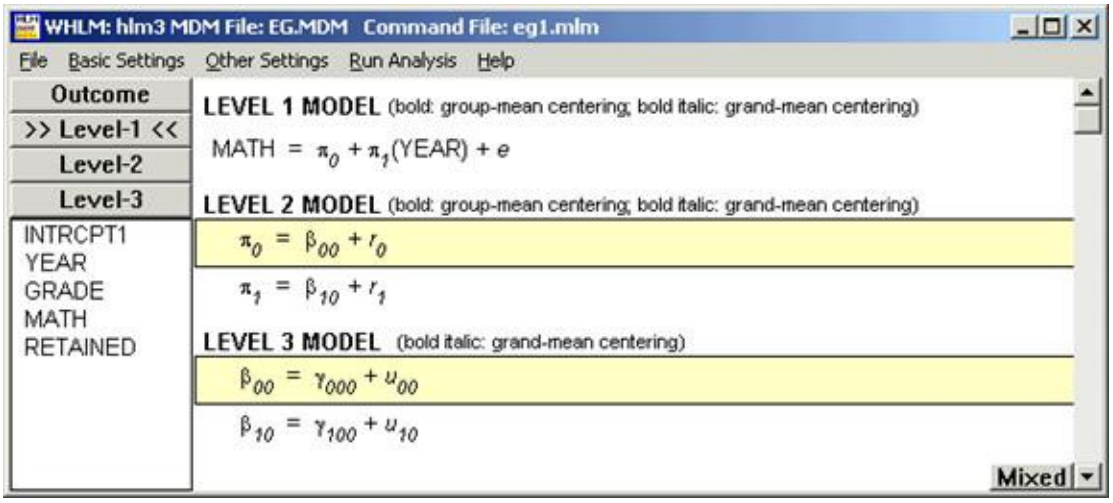
The contents and use of the additional output files gamvc.dat and gamvcr.dat

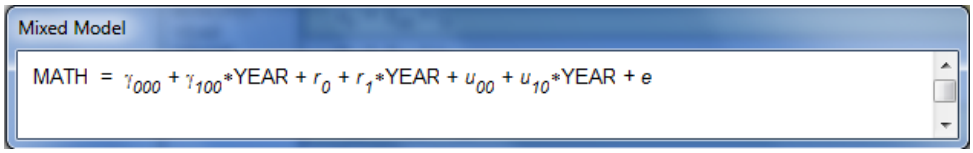
Additional output files are obtained by selecting the **Output Settings** option from the **Other Settings** menu to bring up the **Output Settings – HLM3** dialog box. On this dialog box, the **Print variance-covariance matrices** option should be checked.



With the above selection, there will be three variance-covariance files created along with the output file, these being **gamvc.dat**, **gamvcr.dat** and **tauvc.dat**. The contents of **tauvc.dat** is discussed elsewhere. The contents and use of **gamvc.dat** and **gamvcr.dat** are illustrated here, using the random intercept and slope HLM3 model with the Public Schools data shown below.

Note that the **gamvc.dat** and **gamvcr.dat** files produced are the same regardless of whether full or restricted maximum likelihood is used for the estimation of HLM2 models. The first of these files, **gamvc.dat**, contains the variance covariance matrix of the gammas; the second, **gamvcr.dat**, the robust variance-covariance matrix of gammas. These additional output files are only produced by the HLM2 and HLM3 modules.





This model contains two fixed effects as shown in the **Mixed Model** screen above: the intercept γ_{000} and the slope γ_{100}.

Gamvc.dat contains the gammas and the gamma variance-covariance matrix. The **gamvc.dat** file in this example is shown below:

```
    -0.7793094        0.7630285
3.3441936E-003  3.1458935E-004
3.1458935E-004  2.3294851E-004
```

We know that the number of fixed effects is $f = 2$, and as shown above the estimates of the level-3 intercept γ_{000} and slope γ_{100} are -0.7793094 and 0.7630285 respectively. After the estimates of the gammas is the variance-covariance matrix for the gammas. The estimated standard error for γ_{000} and γ_{100} are the square root of 3.3441936E-003 and 2.3294851E-004

respectively. Hypothesis tests and confidence intervals for the individual s may be constructed using this information. For example, we can compute the 95% confidence interval for the slope effect γ_{100} can be computed using the information in and the degrees of freedom associated with the estimated effect in the regular output file as:

$$\begin{aligned} 95\%\ C.I.\ of\ \gamma_{100} &= \hat{\gamma}_{100} \pm t_{(0.025,d.f.)} \times \left(\hat{Var}\left(\hat{\gamma}_{100} \right) \right)^{\frac{1}{2}} \\ &= -0.763\ \mathrm{m}t_{(0.025,59)} \times \sqrt{2.3294851 \times 10^{-4}} \\ &= -0.763 \pm 0.097 \\ &= \left(-0.860, -0.666 \right) \end{aligned}$$

The interval not including zero will lead to the rejection of the null hypothesis $H_0 : \gamma_{100} = 0$ and the conclusion that the fixed effect γ_{100} is significant, in other words that the MATH achievement changes significantly over YEAR.

Gamvcr.dat contains level-3 fixed effects, the gammas, and the gamma variance- covariance matrix used to compute the robust standard errors. The **gamvcr.dat** file in the example is given as shown below:

```
-0.7793094        0.7630285
 3.3442648E-003   3.1462916E-004
 3.1462916E-004   2.3288284E-004
```

To compute the 95% confidence intervals for the individual fixed effect with the robust standard error, we use the corresponding variances provided in the variance-covariance matrix of this file. For example,

$$\begin{aligned} 95\%\ C.I.\ of\ \gamma_{100} &= \hat{\gamma}_{100} \pm t_{(0.025,d.f.)} \times \left(\hat{Var}\left(\hat{\gamma}_{100} \right) \right)^{\frac{1}{2}} \\ &= -0.763\ \mathrm{m}t_{(0.025,59)} \times \sqrt{2.3288284 \times 10^{-4}} \\ &= -0.763 \pm 0.097 \\ &= \left(-0.860, -0.666 \right) \end{aligned}$$

We can compare this result with what we have obtained above with the model-based standard error. The fact that the two confidence intervals are essentially the same implies that the hypothesis test $H_0 : \gamma_{100} = 0$ is not sensitive to the tenability of the HLM assumptions of multivariate normality (for more information about robust standard errors, see pg. 303 of *Hierarchical Generalized Linear Models*).