# Hierarchical Linear Modeling Example

The Model:

Level-1  , where *rij* ~ N(0, *σ*2)

Level-2 $β\_{0j}=γ\_{00}+γ\_{01}(Sector)\_{j}+γ\_{02}(MeanSES)+u\_{0j}$; where *u*0*j*~ N(0, τ00)

$β\_{1j}=γ\_{10}+γ\_{11}(Sector)\_{j}+γ\_{12}(MeanSES)+u\_{1j}$; where *u*1*j*~ N(0, τ11)

Y: student math achievement score

SES: SES level of the student [group-mean centered]

Sector: 1 = Catholic School, 0 = Public School

MeanSES: mean SES level of the school

Research Questions:

Is student SES related to achievement (is there an equity effect)?

Does the school achievement level depend on the school level of SES and the Sector of the school?

Does the SES slope (equity) vary as a function of school level of SES and the Sector of the school?The outcome variable is MATHACH

 Final estimation of fixed effects:

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 Standard Approx.

 Fixed Effect Coefficient Error T-ratio d.f. P-value

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 For INTRCPT1, B0

 INTRCPT2, G00 12.096006 0.198734 60.865 157 0.000

 SECTOR, G01 1.226384 0.306272 4.004 157 0.000

 MEANSES, G02 5.333056 0.369161 14.446 157 0.000

 For SES slope, B1

 INTRCPT2, G10 2.937981 0.157135 18.697 157 0.000

 SECTOR, G11 -1.640954 0.242905 -6.756 157 0.000

 MEANSES, G12 1.034427 0.302566 3.419 157 0.001

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 Final estimation of variance components:

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 Random Effect Standard Variance df Chi-square P-value

 Deviation Component

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 INTRCPT1, U0 1.54271 2.37996 157 605.29503 0.000

 SES slope, U1 0.38590 0.14892 157 162.30867 0.369

 level-1, R 6.05831 36.70313

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Based on the unconditional model, 18% of the variation in student achievement scores is between schools.

Based on the full model, we see that the average school level of achievement (B0) varies significantly across schools: Var(U0) = 2.38, p<0.000, conditioned on student SES.

This model has explained 72% ([8.614-2.38]/8.614) of the variation in school means.

School level of achievement (B0, the school mean) is a function of Mean SES (G02 = 5.33, p<0.000) and Sector (G01 = 1.23, p=0.001).

 This shows that we see higher school achievement in schools with higher Mean SES and in Catholic schools.

The SES slope (B1, the equity effect) is a function of Mean SES (G12 = 1.03, p<0.000) and Sector (G11 = -1.64, p<0.001).

 This shows that schools with higher SES are less equitable (have higher SES slopes) and Catholic schools are more equitable (have lower SES slopes).