NELS Data ex Kreft + DeLeeuw text

Empirical Exs. Multilevel — 10 schools ex.

Week 4
Stat 209

①

Math ach (Y) on homework (X)

INTRODUCING MULTILEVEL MODELING

Table 2.4 Aggregate regression for 10 schools $\bar{Y}$ on $\bar{X}$

	Null model		With homework	
	EST	SE	EST	SE
Intercept	51.3	2.44	37.1	4.03
Slope b_B	n.a.		7.0	1.84
R^2	0.00		0.64	
$\hat{\sigma}$	39.3		24.9	

$\beta^T_{YX} = 3.6$

NELS data in influence.ME package

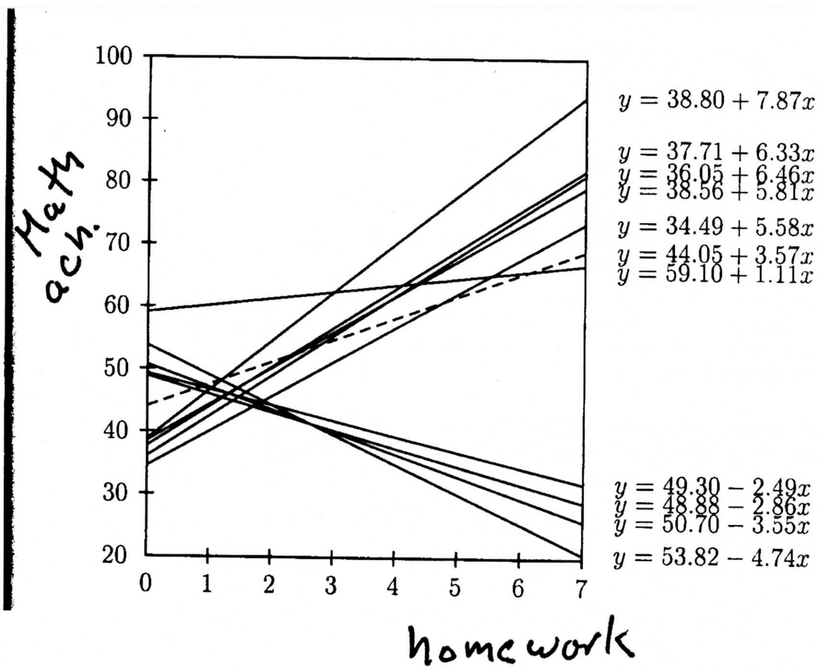
Table 2.6 Cronbach model for 10 schools Y on $X-\bar{X}, \bar{X}-\bar{\bar{X}}$

	Null model		With homework	
	EST	SE	EST	SE
Intercept	51.3	0.69	37.1	1.46
Slope b_W	n.a.		2.1	0.43
Contextual effect b_B	n.a.		7.0	0.67
R^2	0.00		0.34	
$\hat{\sigma}$	11.1		9.0	

Table 2.5 Contextual model for 10 schools Y on $X, \bar{X}$

	Null model		With homework	
	EST	SE	EST	SE
Intercept	51.3	0.69	37.1	1.46
Slope b_W	n.a.		2.1	0.43
Contextual effect $b_B - b_W$	n.a.		4.9	0.79
R^2	0.00		0.34	
$\hat{\sigma}$	11.1		9.0	

w/in school fits (n=10)



"slopes as outcomes" (multilevel analysis)

why slopes differ? school type etc.

Stat 209 WEEK 4 T Burstein RRE another version | Empirical Exs p2 | (2)

"contextual" regression

as if by experiment?

Y on $X, \bar X$
Y on $X, X-\bar X$
Y on $X-\bar X, \bar X$

$$b_{YX\cdot\bar X} = b_w \quad , \quad b_{Y\bar X\cdot X} = b_B - b_w$$
$$b_{YX\cdot(X-\bar X)} = b_B \quad , \quad b_{Y(X-\bar X)\cdot X} = b_w - b_B \qquad (15)$$
$$b_{Y(X-\bar X)\cdot\bar X} = b_w \quad , \quad b_{Y\bar X\cdot(X-\bar X)} = b_B \quad \text{orthogonal}$$

For a single independent variable, the equation for the contextual effects model can be written as

$$Y_{ij} = a_Y + b_{YX\cdot\bar X}X_{ij} + b_{Y\bar X\cdot X}\bar X_{i.} + u_{ij} , \qquad (11)$$

$X, \bar X$

where Y_{ij} and X_{ij} are individual-level measures on Y and X for person j in group i, $\bar X_{i.}$ is the mean for group i on variable X, and u_{ij} is a random disturbance term with the usual least squares properties. This equation is the same as Firebaugh's (1978) equation for detecting cross-level bias (Equation 8).

Substantive Interpretations and Estimators of Individual, Contextual, and Frog Pond Effects of Ability on Achievement in Classrooms in Two-effect Models

Type of Effect	Alternative Interpretations		Estimators from Equations 11-13
Individual	A student's ability affects the student's learning and hence measured achievement	β^b (or β^T)	~~[illegible]~~ $b_{YX\cdot(X-\bar X)}$ β^b
Contextual	Psychological (opportunity to learn)—group ability affects instructional practice (e.g., amount of instructional time, topics covered) which, in turn, affects individual learning and achievement	$\beta^b - \beta^w$	~~[illegible]~~ ~~[illegible]~~
	Sociological (normative climate, reference group)—group ability affects individual motivation to learn and hence individual learning and achievement		
Frog Pond	Psychological (opportunity to learn)—the student's relative standing within the group affects the allocation of instructional resources and style of instruction provided the student and thereby the student's learning and achievement	β^w	$b_{Y(X-\bar X)\cdot\bar X}$ $b_{Y(X-\bar X)\cdot X}$
	Sociological (relative status effects)—relative standing in the group affects individual motivation to learn and thereby individual learning and achievement		

effect of group membership on individual behavior

see m-th facts typos

performance. A model that specifies that individuals' absolute (X_{ij}) and relative $(X_{ij} - \bar X_{i.})$ standing on some characteristic both affect their outcomes can be written as

$$Y_{ij} = a_Y + b_{YX\cdot(X-\bar X)}X_{ij} + b_{Y(X-\bar X)\cdot X}(X_{ij} - \bar X_{i.}) + u_{ij} , \qquad (12)$$

$X, X-\bar X$

with $b_{YX\cdot(X-\bar X)}$ measuring the individual effect and $b_{Y(X-\bar X)\cdot X}$ measuring the frog pond effect. If, instead, it is believed that individual outcomes are affected by the group level $(\bar X_{i.})$ and the individual's relative standing in the group $(X_{ij} - \bar X_{i.})$, the model can be written as

$$Y_{ij} = a_Y + b_{Y(X-\bar X)\cdot\bar X}(X_{ij} - \bar X_{i.}) + b_{Y\bar X\cdot(X-\bar X)}\bar X_{i.} + u_{ij} , \qquad (13)$$

$X-\bar X, \bar X$

where $b_{Y(X-\bar X)\cdot\bar X}$ *and* $b_{Y\bar X\cdot(X-\bar X)}$ are interpreted as measures of frog pond and contextual effects, respectively.