Value-Added Analysis: Issues in the Economics Literature

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Three Topics

- Non-random assignment of students to teachers & schools
- Model misspecification (functional relationship between schooling inputs and achievement)
- Problems with standardized achievement tests

Non-random assignment

- Value-added assessment (VAA) controls for students' starting levels of achievement
  - Gain scores
  - Including prior achievement as a covariate
  - Entire history of scores (empirical Bayes' estimates)
- Is this enough?

  Other variables, measured or unmeasured, may influence rates of gain. Potential for confounding their influence with teacher or school effects.

Let X denote a set of measured variables thought to influence gains.

- Student characteristics (race, SES…)
- Classroom, school or community-level variables (peer characteristics, spillover across teachers, school leadership, school resources, adult role models, social capital). "Context" variables.

Solution 1: Include X as covariates.

- Problem: Removes some of the impact of teachers & schools. VA measures the residual influence of teachers & schools. Not enough left in the residual.

  (If X doesn't vary systematically across teachers or schools, there's no problem. But then we don't need to control for X in the first place.)

Solution 2: Include X as covariates in models that also include teacher fixed effects.

- Requires repeated observations on teachers over time (Ballou, Sanders, and Wright) or across classrooms (Rockoff).
- Coefficients on X are not biased by correlation between X and average effect of the teacher.
- Fixed effects estimates themselves need not be our final, “best” estimates of teacher effects. Instead, use partial residuals in a second-stage model to estimate teacher value added.

- Can we do the same for schools?
  - More problematic. Given turnover among teachers, administrators, students, as well as changes in neighborhoods, controlling for a school fixed effect may leave considerable residual correlation between school effects and X.

Even for estimating teacher value added, there are problems:

- X may not vary much within teacher. Especially true of context variables (e.g., mean SES).

  Consequences: imprecision, noisy estimates dominated by anomalous cases (teachers switching schools, schools being restructured)

- Biased estimates of effects of X, when within-teacher variation in X is correlated with changing teacher effectiveness.
  - New teachers for whom X changes as they become more effective
  - Teachers who face a period of adjustment when faced with students they are not used to

- We want X to proxy unmeasured variables (e.g., race/ethnicity as proxies for family circumstances, neighborhood characteristics). This can be adversely affected by adding fixed effects to the model.

  – Without teacher/school fixed effects in the model, the zero-order correlation between included and omitted covariates determines how well the former proxy for the latter.

– With teacher fixed effects in the model, it is the correlation that remains after removing mean differences in achievement between teachers. This may be much weaker.

Conclusion:

1. Simple ANCOVA tends to over-control, leaving too little in the residual to capture differences among teachers (schools).

2. The two-step procedure tends to under-control, leaving too much of the influence of unmeasured variables for which we hope X proxies.

Other approaches to controlling for unmeasured variables

- Include fixed effects in the model for individual students, cohorts of students, schools, grades within schools, districts, cities, states…

Problems:

- These models limit the inferences that can be drawn about teacher (or school) effectiveness.
  - Example: Controlling for school effects in an analysis of teacher value added
- Some unmeasured variables are difficult if not impossible to model this way.
  - Example: Classroom context variables (e.g., peer influences).

- Models with fixed effects impose stricter exogeneity requirements. Zero contemporaneous correlation does not suffice.

  The quality of the teacher assigned in year t needs to be uncorrelated with time-varying factors that influence growth in other years.

  Rothstein (2007) has presented research on North Carolina elementary schools indicating this condition is not met.

Final Thoughts

- It’s harder than you think to undo non-random assignment with post-hoc statistical adjustments.
- Do we need to? Unfortunately, yes.

  - Peer (neighborhood) effects literature—there are big influences on achievement that vary systematically across schools, classrooms.

  - Instability of value-added measures also suggests that make-up of the classroom matters. What if this doesn’t average out over time?