Estimating Schooling Effects

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Background

School Evaluation
- Two broad reasons for estimating a “schooling effect” on student achievement
  - Research
    - e.g. What makes one school more or less effective than another?
  - School Accountability
- Three broad methods for estimating school effects
  - “Snapshot” estimates
    - e.g. percent proficient
  - Year-to-year gain-scores
  - Estimates the gain in student test scores from one year to the next
  - Longitudinally
    - Uses multiple years of data to fit a growth function to the entirety students’ data

Goal

The goal of this project is to determine the most appropriate method for estimating a “school effect” on student achievement.

Why does this matter?

Estimating a schooling effect is critical to both research and accountability.

For research, if we fail to adequately measure school effectiveness, then our ability to identify factors that influence school effectiveness are limited.

For accountability, if we fail to adequately measure school effectiveness, then schools will be unfairly rewarded or penalized.

The Big Picture

Different methods for estimating school effects can provide substantially different pictures of school effectiveness (e.g., Zvoch & Stevens, 2008).

Three General Methods

- “Snapshot” estimates
  - Used under the No Child Left Behind Act (NCLB, 2001)
  - Estimates based off a single test score from a single point in time (e.g., Percent Proficient)

- Year-to-year gain-scores
  - Estimates school effects based on students test score gains from one year to the next
  - Many accountability metrics moving this direction (e.g., value-added models)

- Longitudinal
  - Uses multiple years of data to fit a growth function to the entirety students’ data
  - Most commonly used in research

Benefits and Challenges For Each Method

Snapshot Methods
- Benefits: Easily interpretable – if students don’t reach a performance level expectation, the school doesn’t either.
- Challenges: Snapshot methods do not account for any student growth that occurs. Estimates have been shown to be biased (Kim & Sunderman, 2005; Zvoch & Stevens, 2008).

Year-to-Year Gain Methods
- Benefits: Account for student gains from one year to the next.
- Challenges: Not true “growth”. Reliability of gain scores are often low (Singer & Willett, 2003). Far more complex computationally, requiring clear communication for stakeholders to understand how schools are being evaluated. Linear (straight line) growth from one year to the next must be assumed.

Longitudinal Methods
- Benefits: Provide the most complete account of student learning, which often leads to more stable and reliable school effect estimates.
- Challenges: Computationally complex. Essentially all the oft-discussed issues related to longitudinal modeling apply (see Singer & Willett, 2003). Handling of student mobility can be particularly tricky, as typical applications require a “pure” nesting structure.

Recommended Method - Longitudinal

Nesting Structures
- Perhaps the greatest challenge to longitudinal designs is that they typically require a “pure” nesting structure. That is, every student is a member of one, and only one school.

Schematic: Pure nesting structure

Students

Schematic: Crossed nesting structure

Students

Practical Repercussions

Research
- The choice of one model for school effectiveness over another can have substantial impacts on the overall “picture” of school effectiveness. In research, snapshot methods are used relatively infrequently. Instead, gain-score or longitudinal models are employed, which each typically produce better overall estimates of school effectiveness (Zvoch & Stevens, 2008).
- Yet, even when longitudinal models are employed a listwise deletion or first/last school method is generally adopted (Grady & Beretvas, 2010).

Inadequate estimates of school effects in research could potentially lead to:
- School-wide reform efforts being inappropriately labeled as “effective” or “ineffective”
- Schools appearing (incorrectly) to exhibit bias for or against specific student subgroups.
- Resources being inappropriately devoted to studying “outlier” schools that are particularly effective despite circumstances

Accountability
- For accountability, snapshot methods have historically been the norm (see NCLB, 2001), however, they have come under considerable criticism given some of the critiques outlined here. Thus, accountability policies have begun to focus more on student learning. To date, however, these have mostly all fallen under the “year-to-year gain-score” method.

Inadequate estimates of school effects in accountability policies could potentially lead to:
- Schools being unfairly labeled as “failing” or “succeeding”
  - e.g. Schools are then unfairly sanctioned or rewarded
- Public trust in the effectiveness of specific schools may be unduly high or low
- May lead to a “rich get richer while the poor get poorer” dilemma, given that some methods have been shown to be biased against schools serving high proportions of ethnic minorities and students from impoverished backgrounds (Kim & Sunderman, 2005; Zvoch & Stevens, 2008).

Dealing with crossed nesting structures

First/Last School Method
- Researchers applying the first or last school method to studying school effects treat the entirety of the students’ data as being representative of only the first or last school attended. This method biases school effect estimates by attributing student data as representative of the school when the student no longer attends the school (See Grady & Beretvas, 2010).

Listwise Deletion Method
- Researchers applying listwise deletion remove all students from the dataset who transition schools at any point during the study. This method makes studying any time frame including a middle-school transition impossible. Estimates remain biased due to the final sample being unrepresentative of the full sample (unless mobility is low, See Luo and Kwek, 2012).

Cross-Classified Models
- An alternative is to model the observed relationships with students being members of each school. Models are considerably more complex, but provide the best representation of the observed relationships.

Contact Information and Acknowledgements

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References


