Comments on “Exploring Student-Teacher Interactions in Longitudinal Achievement Data” by J.R. Lockwood and Daniel McCaffrey

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Basic Goal and Results

- To test whether teacher effects vary with student ability, while improving on past efforts that have used a single measure of past achievement
- Basic innovation: Use all past scores from all subjects to estimate a single measure of student "ability" and use that instead of a single lagged test score
- Find that variations exist but account for only a fraction of the total variation in teacher effects

The Set-up and Potential Issues

$$Y_i = \mu + \delta_i + \theta_{oj(i)} + \theta_{1j(i)}\delta_i + \varepsilon_i$$

$$Z_{ip} = \mu_p + \beta_p\delta_i + \varepsilon_{ip}$$

Here Y_i is test score and Z_{ip} is set of lagged test scores.

Partial list of problems:

1)Omitted variable bias

2)Endogeneity of $\theta_{kj(i)}$ where k=0, 1

3)Biased estimates of δ_i in second equation possibly:

1) Are all subjects suitable for use as a Z_{ip}?
2) Is there truly a single measure of general ability?

3)Do teachers respond to the types of students in the class (e.g. median voter model)? If so then relative effectiveness with low and high ability students may depend on who is in the classroom. (Endogeneity)

4)If main teacher effects are unstable, then won't the interactions also be unstably estimated?

We Face Just a Few Challenges in This Literature

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1)Omitted variable bias

1) The error term has loaded into it a large number of omitted variables:
    1) time-varying AND constant student traits not fully captured by lagged scores,
    2) environmental variables,
    3) curriculum,
    4) **peers.**
5) ALL of these likely correlated with δ_i and $\theta_{kj(i)}$

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How Stable are Estimates of Teacher Effectiveness? (Koedel and Betts, 2006)

Re-estimate model using a different three-year window (with overlap of 2 of 3 years).

Table 5. Persistence of Teacher Fixed Effects Estimates across Data Subsets

		Teacher Quintile Rankings from Year t				
Teacher		1	2	3	4	5
Quintile	1	***30***	***20***	***19***	***18***	***13***
Rankings	2	***23***	***25***	***13***	***21***	***18***
from Year	3	***18***	***20***	***25***	***24***	***13***
t-1	4	***15***	***16***	***26***	***20***	***23***
	5	***13***	***17***	***16***	***19***	***35***

Note: Teachers are placed into quintiles using coefficient estimates from each data subset separately, quintile 5 being the best. Rows and columns sum to 100 percent.

Bayesian Approach

- Essential idea is to posit a conditional probability distribution, and distributions of unknown parameters, and to update based on the actual distribution of observables
- The teacher and student general ability terms are assumed to be independent. (No sorting)
  - Can inclusion of enough lagged scores Z_{ip} solve this?
    - Lockwood and McCaffrey (2007) suggest the answer is yes
  - But then the approach is probably not usable below upper elementary grades or middle school
    - How about using lagged GPA as well?

One Possible Extension

- The basic model

$$Y_i = \mu + \delta_i + \theta_{oj(i)} + \theta_{1j(i)}\delta_i + \varepsilon_i$$

- is extended to include non-linearities:

$$Y_i = \mu + \delta_i + f(\delta_i^2) + \theta_{oj(i)} + \theta_{1j(i)}\delta_i + \varepsilon_i$$

- What about also trying a non-linear estimate of the interaction with student ability?

$$Y_i = \mu + \delta_i + f(\delta_i^2) + \theta_{oj(i)} + \theta_{1j(i)}\delta_i + \theta_{2j(i)}g(\delta_i^2) + \varepsilon_i$$

Overall....

- A very thoughtful and helpful paper:
  - Answers the interaction question in a probably more reliable way than some of the earlier authors, (although I want to see more covariates)
  - Comes up with a conclusion not vastly out of line with earlier work: variations in teaching effectiveness are not a huge component of overall teacher effects