Teacher mobility and student achievement

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Work in progress April 2013

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Motivation and background

- Literature emphasises the importance of unobserved teacher quality on student achievement
  - Hanushek, Rivkin and others
- Less known about the impacts of teacher turnover
- Teacher turnover may matter for student achievement because it causes churning in the quality of teachers to which a student is exposed
  - Students may lose good teachers and gain bad ones or vice versa
  - Hanushek et al (2005) estimate impact of teachers based on this assumption
- Teacher turnover, for given quality, may matter because a change of teachers is disruptive to learning
  - Assimilation of teachers into school, different teaching methods

Basic approach and headline results

- Key question: what impact does teacher turnover have on student achievement?
- Unique administrative teacher workforce data for England from 1999-2002
- Matched to by school and subject to individual student achievement data on qualifications at end of compulsory schooling (GCSEs, age 16)
- We estimate the net impact of school-by-subject specific entry and exit rates over two years prior to GCSEs on student's attainment.
- Significant, but moderate effects. 25 percentage points higher annual mobility (one s.d.) leads to 0.04 standard deviation decrease in attainment

Challenges to 'causal' interpretation

- Teacher mobility determined by unobserved attributes of school and student body
- Fixed effects designs to control for unobserved school or student quality
- Student-by-subject-by-year data allows various alternatives
  - School and subject fixed effects and estimate from variation across subjects over time within schools
  - Student fixed effects and estimate from variation across subjects for the same student (within the same school and year)
  - School-by-subject fixed effects and estimate from variation within subject-school groups over time. This approach limited by only 3 years of data

Existing literature

- Not much: mainly coming from the US
- Hanushek and Rivkin (2010) find that teachers who stay in the school tend to be more effective than those who leave school, and that this gap is larger for schools serving low income students.
- Ronfeldt et al. (2012) find that teacher turnover has a significant and negative effect on achievement in both math and English for 5th graders in New York
  - Teacher turnover is particularly harmful to students in schools with a high proportion of low performing and black students.

Data

- Database of Teacher records, 1999-2002
  - Historical data, unavailable in later years. Superseded by School Workforce Census, from 2010 but too recent for this analysis
  - Information on pay, qualifications, degree subject, main teaching subject, workplace school, length of service, age gender etc.
  - Mobility measures constructed based on changes in school workplace
- National pupil database, England
  - Administrative student level data including information on school leaving age qualifications (GCSEs), prior test scores (age 14). Student characteristics available but only 2002 on.

School-by-subject linking

- Students and teachers linked by school and GCSE subject identifiers
- Teaching subjects coded to match GCSEs based teachers' main specialism in DTR
- Around [26062] school-subject groups
- Mathematics, science, English, modern foreign languages, arts, humanities, history. General studies, etc.

Estimation

- Individual student data linked to a panel of school-x-subject measures of teacher turnover
- Various fixed effects strategies based around
- $testscore_{isqt} = \beta mob_{sqt} + a_{\ i} + b_{sq} + c_{\ st} + d_{qt} + \varepsilon_{isqt}$
- i: individual, s: school, q: qualification subject, t: year (=cohort)
- Other control variables for teacher characteristics
- Alternative mobility measures: entry rates, exit rates, entry from outside profession, exit to outside profession, entry rates by teacher qualifications, pay etc.

Results descriptives and 'balancing':

	Zero entry: N=3901985				Non-zero entry: N=1844150			
	mean	s.d	min	max	mean	s.d	min	max
GCSE points	45.5	28.0	0	97	45.8	27.6	1	97
Age 14 scores	45.50	28.42	0	97	49.87	28.87	0	100
Entry	0	0	0	0	0.333	0.215	0.012	1
Exit	0.087	0.161	0	1	0.183	0.238	0	1
Entry to prof	0.097	0.173	0	1	0.104	0.146	0	0.889
Exit from prof	0.042	0.174	0	1	0.039	0.158	0	0.960
Salary	23958	4095	1	64000	24021	3357	14658	49964
First class deg	0.044	0.152	0	1	0.777	0.246	0	1
Second class	0.749	0.335	0	1	0.042	0.107	0	1
Tenure days	2405	1352	273	17944	2266	988	308	12630
Service days	2287	1262	90	13407	2130	917	237	10797
Male	0.395	0.369	0	1	0.382	0.275	0	1
Age <30	0.300	0.330	0	1	0.333	0.257	0	1
Age 30-39	0.491	0.368	0	1	0.481	0.270	0	1

Results overall entry:

	t fixed effects	s+q + t fixed effects	s_t+q_t fixed effects	s x q + t fixed effects	a_i fixed effects
Overall entry	**- 3.106*** **	**-0.722*** **	**-0.741*** **	**-0.275*** **	**-1.151*** **
0-1 scaled	**(0.722)**	**(0.042)**	**(0.046)**	**(0.054)**	**(0.013)**
Teacher Xs	No	No	No	No	No
Age 14 scores	No	No	No	No	-
Obs	7537340				

- Key point:

Results overall entry, conditional:

	t fixed effects	s+q + t fixed effects	s_t+q_t fixed effects	s x q + t fixed effects	a_i fixed effects
Overall entry	**-2.984*** (0.045)**	**-0.729*** (0.125)**	**-0.745*** (0.046)**	**-0.280 (0.054)**	**-1.130 (0.029)**
0-1 scaled					
Teacher Xs	Yes	Yes	Yes	Yes	Yes
Age 14 scores	Yes	Yes	Yes	Yes	-
Obs	7537340				

- Key point:

Results by entry type:

	t fixed effects	s+q + t fixed effects	s_t+q_t fixed effects	s x q + t fixed effects	a_i fixed effects
Entry to prof.	**-3.377*** (0.046)**	**-0.797*** (0.127)**	**-0.824*** (0.047)**	**-0.296*** (0.055)**	**-1.148*** (0.029)**
Entry other	**-2.822*** (0.05)**	**-0.440*** (0.141)**	**-0.464*** (0.052)**	**-0.137*** (0.059)**	**-0.102*** (0.033)**
Teacher Xs	Yes	Yes	Yes	Yes	Yes
Age 14 scores	Yes	yes	yes	yes	yes

Obs 6,265201

- Key point:

Results by exit type:

	t fixed effects	s+q + t fixed effects	s_t+q_t fixed effects	s x q + t fixed effects	a_i fixed effects
Exit from prof.	**-5.371*** (0.059)**	**-0.619*** (0.161)**	**-0.733*** (0.061)**	**-0.268*** (0.06)**	**0.47*** 0.038**
Exit other	**-2.309*** (0.068)**	**-0.161 (0.199)**	**-0.132* (0.07)**	**-0.149* (0.082)**	**-2.599*** (0.04)**
Teacher Xs	Yes	Yes	Yes	Yes	Yes
Age 14 scores	yes	yes	yes	yes	Yes

Obs 6,265,201

- Key point:

Entry by teacher characteristics

- Some robustness checks:
- We find that teacher mobility is not correlated with student prior attainment
- Also uncorrelated with other teacher characteristics, such as salary, degree class, etc.
- Mobility has some heterogeneous effects, but the direction is not clear
- The disruption effect of teachers with first degree class who move is higher than other degrees;

Conclusions

- Teacher mobility reduces student attainment.
- Moderate effects: 0.04 standard deviation fall in score for one standard deviation (25 percentage point) increase in teacher annual entry rate
  - E.g. moving from no new teachers to 1 on 4 new teachers would reduce attainment by 0.04 standard deviations
- Comparison:
  - Unobserved teacher quality: 1.s.d → 0.1-0.2 s.d.
  - Class size effects: 30% reduction → 0-0.2 s.d.
  - Peer effects: 1 s.d. → 0-0.05 s.d.
  - Student mobility (Gibbons and Telhaj 2011): 1.s.d → 0.01 s.d